

**Construction Documents  
Specifications**



Cornell University®

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**BALCH HALL RENOVATION**

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Ithaca, New York

prepared by:

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Date of Issue:  
November 5, 2021

**Volume 1** of 2

**Divisions 00 to 22**



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SELECTIVE SITE DEMOLITION

**PART 1 - GENERAL**

1.1 GENERAL

- A. Requirements set forth herein are in addition to and shall be considered as complementary to the Terms and Conditions for Construction and the balance of Divisions 00 and 01 and Technical Specifications.
- B. All Contractors, Subcontractors, Vendors and the like shall be required to familiarize themselves with said provisions.

1.2 SUMMARY OF WORK

- A. Work Included: Provide labor, materials, equipment, incidental work, and construction methods necessary to complete the work of this Section, including but not limited to the following work items:
  - 1. Protection of Existing Features:
    - a. Protection of all trees, tree grates, concrete and asphalt pavement, concrete and granite curbing, street signage, light poles and luminaires, and all miscellaneous site furnishings and features outside and beyond the Property Line.
    - b. Protection of all existing buildings, including but not limited to:
      - i) Balch Hall
    - c. Protection of existing trees to remain, in accordance with the requirements of the Arborist's Drawings.
    - d. Protection of existing site structures and utilities indicated on the civil engineering drawings, including but not limited to:
      - i) Existing Bus Shelter and foundation.
      - ii) Existing concrete stair at east end of South Balch Hall
  - 2. Remove and stockpile for reuse:
    - a. Existing Signage
  - 3. Remove, dismantle, stockpile and transport for Storage by Owner:
    - a. Existing bluestone pavement
    - b. Site Furniture – excluding bike racks
    - c. Waste Receptacles
  - 4. Removal and Disposal
    - a. Existing bituminous concrete pavement including aggregate subbase as shown on drawings.
    - b. Existing concrete pavement including aggregate subbase as shown on drawings.
    - c. Existing bluestone pavement aggregate subbase.
    - d. Existing concrete stairs and foundations
    - e. Existing stone tread stairs and foundation
    - f. Existing split rail wooden fence and foundation
    - g. Existing galvanized steel stair handrail and epoxy grout core
    - h. Concrete seat wall
    - i. Bike Racks

- j. Turf: by sod cutting and hand work, remove all existing grass turf in the lawn
  - k. Trees, Shrubbery, Perennials and Groundcover as shown on the drawings.
  - l. Miscellaneous existing items as indicated on the drawings, specified in other Sections of these Specifications and as directed by the OPM.
5. Final cleanup.
- a. Removal and disposal of debris materials.

### 1.3 RELATED WORK SPECIFIED UNDER OTHER SECTIONS

- A. Related Work: Many Sections in most Divisions of the Specifications carry related work. Thoroughly review all Sections of these Specifications to identify related work specified elsewhere. The following Sections are identified for Contractor's convenience but do not include all pertinent work specified elsewhere.

- 1. Section 041010 Site Stone
- 2. Section 042500 Site Unit Masonry
- 3. Division 13 Sections as applicable
- 4. Division 23 Sections as applicable
- 5. Division 26 Sections as applicable
- 6. Section 312000 Earthwork
- 7. Section 312500 Sedimentation and Erosion Control
- 8. Section 312550 Mud and Other Soil Debris
- 9. Section 323000 Site Furnishings
- 10. Section 329200 Sod
- 11. Section 329300 Planting
- 12. Division 33 Sections as applicable

### 1.4 SUBMITTALS

- A. Refer to SECTION 013300-SUBMITTALS for submittal provisions and procedures.
- B. Within 30 days of Notice to Proceed submit the following:
- 1. Written narrative describing sequence of demolition, stockpiling, salvaging and removals for all elements described in this Section.
    - i) Inventory of site furnishings and site signage
  - b. Create a spreadsheet to record the following information for all items that will be salvaged for restoration:
    - i) Unique number and description
    - ii) Dimensions of each piece, including wall thickness
    - iii) Surface condition of each piece, with written notes on surface damage, condition of surface coatings. Include photographic record of any and all damage.
    - iv) Any structural damage observed, with written notes on location and kind of damage. Include photographic record of structural damage.
  - c. Record materials and dimensions of all other components, pieces and appurtenances that will be discarded. This record shall serve as a guide to replacement parts for reassembly.
2. Inventory of all items to be removed, reset and cleaned in new locations, including:
- i) Site Signage
- C. Submit Weekly Conditions Reports of removals and stockpiling operations.

1. Upon commencement of removal, stockpile and salvage operations for the site furnishings and site signage, record the conditions of each piece of furnishing and signage removed and palletized for transport. Record all damage to individual pieces, including damage that is apparent prior to removal, damage that is hidden from view, and damage that occurs in the course of removal and stockpiling.
2. Provide photographs of stockpiled site furnishings and site signage.

## **PART 2 PRODUCTS**

### **2.1 TEMPORARY CONSTRUCTION FENCING**

- A. Construction fencing shall be provided enclosing all work and storage areas or where indicated on the drawings. Unless otherwise shown or directed, all fencing shall be 8 feet high, accurately aligned and plumb, adequately braced, and complete with gates, locks, and hardware as required.
- B. UNDER NO CONDITIONS SHALL FENCING BE ATTACHED OR ANCHORED TO EXISTING BUILDINGS, CONSTRUCTION.PAVEMENTS, SITE FURNISHINGS OR TREES.
- C. Fencing shall be as follows:
  1. Construction fencing for use at perimeter of work area shall be equal to commonly available rent-a-fence products. Fencing shall be panels of chain link fence in new or near-new condition. Fabric shall be uniform, square mesh diagonal pattern measuring approximately 2 inches on its parallel sides. Provide standard 12-foot panel sections, 8-foot height, with vertical and horizontal cross bars. Panels shall be free standing. Provide weights as required to prevent wind-blown failure. Panels shall be connected with approved corrosion resistant wire, ties, or similar attachment system.
- D. Site access gates shall be provided as required of same material as site fence complete with all operating hardware and security devices.
- E. All gates shall be provided with latches and padlocks. All padlocks shall utilize a single master key. The same padlocks and master key system shall be utilized as the fence system is moved around the site. Provide no less than 3 copies of the master key to the Owner for their use.
- F. Contractor shall submit drawings showing type, materials and construction of fencing to Owner's Representative for approval before proceeding with installation.
- G. Should fencing be required to be relocated during the course of the project, same shall be done at the total expense of the Contractor. At the completion of the project, the Contractor shall remove and dispose of the construction fencing.
- H. The construction fence shall be maintained in good order by the Contractor throughout the life of the project.
- I. All construction fencing shall include full height windscreen/privacy fabric, securely attached. Fence installation shall take into account resulting increased effect of wind load.

- J. Remove and replace windscreen/privacy fabric within 3 working days of the fabric having been tagged by spray-applied graffiti paint or the appearance of tears, tatters, frays or rips.

### **PART 3 EXECUTION**

#### **3.1 CONSTRUCTION FENCING**

- A. Install temporary fencing in locations shown on the Contract Documents and as directed by the Cemetery. Install construction fencing with privacy fabric on the south and west sides of the construction area (bordering C-North and along Rogers Avenue). Install tree protection fencing in locations shown on the Drawings.
- B. Install all construction fencing and tree protection fencing prior to the start of any site preparation activities, including clearing and grubbing, earthwork, or similar operations.
- C. Construct and maintain fences around exposed excavations as required for worker's safety.

#### **3.2 PROTECTION OF SITE FEATURES BEYOND THE LIMITS OF WORK**

- A. Protect and retain all site features, pavements, trees, tree grates, curbing, street signage and miscellaneous existing conditions beyond the Limit of Work line as indicated on the Drawings. Restore all elements beyond the Limit of Work line that have been damaged during the course of construction by contractors and subcontractors as directed by the DOR without additional cost to the Owner.

#### **3.3 TREES**

- A. Protect trees to remain in accordance with the requirements the Arborist's Drawings and notes.
- B. Remove trees as indicated on the Arborist's Drawings and in accordance with Arborist's notes.

#### **3.4 PROTECT EXISTING BUILDING AND SITE FEATURES TO REMAIN**

- A. Existing Buildings and Attached/Adjacent Site Features:
  - 1. Without exception, protect the existing buildings and attached/adjacent site features. Maintain a photographic record of existing conditions prior to the start of construction in accordance with Division 01 requirements.
  - 2. Listing of existing buildings and attached/adjacent site features to be protected and retained shall include but may not be limited to those listed in Article 1.2 Summary of Work of this Section.
  - 3. Existing buildings and attached/adjacent site features are assumed to be under the control of the Contractor during daylight hours. Damage to buildings and site features that occur during daylight hours will be repaired at no additional cost to the Owner when responsibility for damage can be attributed to actions/omissions by the Contractor.

#### **3.5 DISMANTLE AND RETURN TO OWNER SITE FURNISHINGS AND SITE SIGNAGE**

- A. Remove, inventory and transport to Owner all site furnishings and signage indicated in the drawings.
- 3.6 SITE UTILITIES TO REMAIN
- A. Coordinate the work of this Article with the work described in the following Divisions:
    - 1. Division 13 Special Construction
    - 2. Division 22 Plumbing
    - 3. Division 26 Electrical
    - 4. Division 33 Utilities
  - B. Maintain functioning site drainage system during the entire course of construction, including but not limited to the site, all architecture to remain, surrounding streets and sidewalks beyond the Limit of Work line.
- 3.7 PROTECT AND RETAIN EXISTING BUS SHELTER AND FOUNDATION
- A. Protect existing Bus Shelter and Foundation to remain as indicated on the drawings.
- 3.8 REMOVAL AND DISPOSAL OF EXISTING SITE ELEMENTS
- A. Stone veneer stairs
  - B. Bike racks
  - C. Split rail fence
  - D. Galvanized steel stair handrail and epoxy grout core
- 3.9 PAVEMENT REMOVAL AND DISPOSAL
- A. In all areas indicated on the Drawings, remove and dispose of existing pavement systems within Limit of Work Lines offsite in a legal manner, including but not limited to the following:
    - 1. Bituminous Concrete Pavement and aggregate base
    - 2. Concrete Pavement and aggregate base
    - 3. Bluestone Pavement and aggregate base
- 3.10 REMOVAL OF CAST-IN-PLACE CONCRETE STRUCTURES
- A. Removal and disposal of cast-in-place concrete structures to include but not be limited to the following:
    - 1. Concrete seatwall
    - 2. Concrete stairs and foundation
    - 3. Stone veneer foundation
    - 4. Split rail fence foundation
- 3.11 TREES, SHRUBBERY, PERENNIALS, GROUNDCOVER, VINES AND PLANTING SOIL
- A. As indicated on the Drawings, remove and dispose of trees, shrubbery, perennials, groundcover and vines in accordance with the requirements of Section 311316 Tree Pruning.

- B. Remove and dispose of planting soil in lawn panels, plant beds, planters and miscellaneous locations so indicated and as directed by the Owner's Representatives.
- C. Dispose of all materials offsite in a legal manner.

END OF SECTION

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Section 02 41 19  
SELECTIVE DEMOLITION

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. General: The work described in this Section consists of selective demolition, cleaning, removal and legal disposal of all structures, equipment and materials indicated for demolition, or careful removal and temporary storage of materials and equipment indicated for salvage and re-use, or salvage and delivery to Owner.
  - 1. Comply with requirements of Section 01 35 16 - ALTERATION PROJECT PROCEDURES, and Section 01 73 29 – CUTTING, PATCHING AND REPAIR.
- B. Pre-construction examination: Perform ground penetrating radar assessment prior to performing chipping, saw cutting, or core drilling through concrete as specified under Section 01 73 29 – CUTTING, PATCHING AND REPAIR.
- C. Permits: Obtain and pay for all demolition and construction permits required by local authorities having jurisdiction and other regulatory agencies and utility companies.
- D. Selective demolition and removal work includes the following at indicated locations, but is not limited to:
  - 1. Cut existing concrete slabs and trench at floor drains and plumbing located beneath slabs-on-grade. Remove concrete slabs where indicated.
  - 2. Remove existing lights, diffusers, grilles, speakers and similar equipment where scheduled to be replaced.
  - 3. Remove wood storage shelving, cabinetry, casework and similar items
  - 4. Remove designated exterior walls, interior partitions, ceiling and suspension systems, and flooring systems
  - 5. Remove designated building specialties, including toilet partitions and toilet accessories.
  - 6. Remove designated doors, frames and associated hardware. Disconnect abandoned wiring and accessories for electrified hardware.
  - 7. Remove all furnishings, utilities, equipment and fixtures, not indicated for salvage or re-use, and abandoned materials of all kinds.
  - 8. Remove from site all abandoned, disconnected and dismantled fire protection, plumbing and mechanical equipment, including piping, conduits, system wiring, meters and other devices.

9. Remove from site all abandoned, disconnected and dismantled electrical fixtures and equipment, including conduits, wiring, meters and other devices.
  10. Removal of existing areaway gratings.
  11. Removal of brick at base of areaways.
  12. In addition to demolition specifically shown, cut, move or remove existing construction to remain as necessary to provide access or to allow alterations and new work to proceed. Coordinate such relocation's and removal to accommodate the demands and requirements of other trades.
  13. Removal of unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals and deteriorated concrete.
- E. Selective demolition and removal work by individual utility, mechanical and electrical trade subcontractors includes, but is not limited to the following:
1. Each trade subcontractor shall Disconnect cut, cap and make safe all utilities, equipment and fixtures which are not indicated for salvage or re-use, or otherwise indicated to be abandoned in place as well as any abandoned materials of any kind.
    - a. Disconnect cut, cap and make safe, all utility services indicated to be demolished at their primary source. Obtain the approval from authorities having jurisdiction, or applicable service provider prior to the execution of the work.
    - b. Cut, cap and make safe all existing utility services indicated to be abandoned in place, where so indicated on the Drawings.
  2. Elevator subcontractor is responsible for removal and legal disposal of designated existing elevators in their entirety, including cabs, counterweights, guide rails, cables, hoistway doors, motors, controls, and signal equipment.
  3. The fire suppression subcontractor shall disconnect, detach and dismantle all existing abandoned sprinkler/fire suppression components including, but not limited to, sprinkler heads, piping, hangers, valves, and appurtenances.
    - a. Suspended hangers, piping, fixtures and appurtenances scheduled for demolition, shall be disconnected and lowered to floor by the fire suppression subcontractor.
  4. The plumbing subcontractor shall disconnect, detach and dismantle all existing abandoned plumbing systems and equipment including, but not limited to, fixtures, equipment, water heaters, piping, hangers, valves, insulation and appurtenances.
    - a. Piping at slab will be disconnected by plumbing subcontractor.
    - b. Suspended hangers, piping, equipment, fixtures and appurtenances scheduled for demolition, shall be disconnected and lowered to floor by the plumbing subcontractor.
  5. The HVAC subcontractor shall disconnect, detach, dismantle all existing abandoned heating, ventilating, and air conditioning systems including, but not limited to, air handlers, air conditioners, pumps, cabinet unit heaters, unit heaters, radiation, exhaust fans, intakes, louvers, diffusers, grilles, and all related piping, ductwork, controls, and appurtenances.



- a. Suspended hangers, equipment, ductwork and appurtenances scheduled for demolition, shall be disconnected and lowered to floor by HVAC subcontractor.
6. The Electrical subcontractor shall disconnect, detach, dismantle all existing abandoned electrical systems and equipment including, but not limited to, panelboards, light fixtures, fire alarm, intercom, speakers, wiring devices, and all related conduit and appurtenances.
  - a. Suspended wiring, conduit, hangers, fixtures, equipment, and appurtenances scheduled for demolition, shall be disconnected and lowered to floor by the Electrical subcontractor.
7. Remove, salvage and furnish to the General Contractor designated equipment, fixtures or other items so identified. Refer to notes on Drawings.
8. Identify locations of utilities for work of other sections.
- F. Remove, salvage and provide storage for removed materials, equipment and furnishings indicated for re-use, including but not limited to:
  1. Historic light fixtures, to be retrofit and reinstalled.
  2. Designated doors for re-use as wall paneling.
  3. Additional items designated on Drawings.
- G. Remove, salvage, and furnish to Owner for maintenance stock, or other future use, the following products. Carefully package and clearly identify prior to delivery to Owner.
  1. Window hardware.
  2. Door hardware.
- H. Due to the historic nature of project, conduct a special walk-through of the existing site prior to commencement of any demolition work. Jointly identify and tag with Owner additional items not indicated on Drawings but are required to be salvaged. These products in general would include unsuitable or extraneous materials not previously indicated to be salvaged.
  1. Identify products for salvage and reuse.
  2. Identify products for Owner's own future use.
  3. Identify products of historic significance for salvage and determine disposition.
- I. Identify locations of utilities for work of other sections.

### 1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 40 00 – ARCHITECTURAL WOODWORK: Repurpose and Installation of salvaged panel doors as wall panels.

- D. Section 07 31 26 - SLATE SHINGLE ROOFING: Removal of existing slate roofing and building paper.
- E. Division 21 - FIRE SUPPRESSION
  - 1. Disconnection, salvage, re-working and re-installation of sprinkler system.
  - 2. Disconnection and dismantling designated fire suppression systems and components.
- F. Division 22 - PLUMBING
  - 1. Disconnection, salvage, re-working and re-installation of plumbing system.
  - 2. Disconnection and dismantling designated plumbing systems and components.
- G. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC):
  - 1. Disconnection, salvage, re-working and re-installation of roof-top ventilator ducts.
  - 2. Disconnection and dismantling designated mechanical systems and components.
- H. Division 26 - ELECTRICAL:
  - 1. Disconnection and dismantling designated electrical systems and components.
  - 2. Disconnection, salvage, and re-installation of designated light fixtures.
- I. Division 31 - EARTHWORK: Excavation and backfilling for foundations, ramps, below-grade utilities, retaining walls, and exterior concrete slabs.
- J. Individual specification sections: Cutting and patching incidental to work of individual specification sections shall be performed by respective trades, except as specified in Section 01 73 29 – CUTTING AND PATCHING.
- K. Individual specification sections: Utility shutoffs by respective trades.

#### 1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ANSI A10.6 – Safety Requirements for Demolition Operations.
  - 2. NFPA 241 – Standard for Safeguarding Construction, Alteration, and Demolition Operations.

#### 1.5 OWNERSHIP OF REMOVED MATERIALS

- A. If during the work, articles of unusual value, or, of historical or archaeological significance, are encountered (which have not previously identified as such in the Contract Documents), the ownership of such articles is retained by the Owner. Upon discovery, immediately furnish to the Architect and Owner, information regarding their discovery Resolution shall be handled as a Change in the Work.

- B. Ownership of materials, equipment and furnishings designated for salvage for re-use in this Project or designated for Owner's use is retained by the Owner.
- C. Ownership of materials, equipment and furnishings to be removed from the Project which are not defined by the above two paragraphs is retained by the Contractor; if any of these are considered of salvageable value to the Contractor, they may be removed from the Project as work progresses.
  - 1. Contractor is requested to coordinate with a local non-profit where practical to allow salvage of construction materials slated for removal that are not identified as salvage by Owner.
    - a. Local not-for-profit organizations for salvage of materials:
      - 1) Ithaca Reuse Center  
214 Elmira Road  
Ithaca, NY 14850
      - 2) Significant Elements  
212 Center Street  
Ithaca, NY 14850
  - 2. On-site storage or sale of removed items is prohibited.

#### 1.6 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Comply with all requirements of this contract relative to protection, scheduling and coordination with the Owner.
  - 2. Hazardous materials: When hazardous materials are encountered, they shall be handled, removed, and disposed of in accordance with all regulatory agency requirements.
  - 3. Coordinate and arrange with utility, mechanical and electrical trades for their disconnecting, rerouting and maintenance of existing services leading to adjacent occupied buildings, as part of the work of this Contract.
  - 4. Coordinate Work of this Section with related utilities work identified in the Contract Documents.
- B. Pre-Demolition Meeting: At least two weeks prior to commencing the work of this Section, conduct a pre-demolition conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
  - 1. Required attendees: Architect, Contractor's project manager and on-site superintendent, demolition subcontractor's project superintendent, and representatives of related utility trades.
  - 2. Conference Agenda:
    - a. Scheduling of demolition operations. Review critical demolition sequencing with other work.
      - 1) Coordination scheduling with Owner's ongoing operations.
    - b. Coordination of utility service requirements and disconnects.
      - 1) Review functioning utility services which are to remain in service throughout demolition work.

- 2) Review requirements for marking location of disconnected utilities, and project record (as-built) requirements.
  - c. Review conditions of existing construction to be demolished.
    - 1) Review extent and location of selective demolition.
    - 2) Review special demolition and salvage procedures required for historic building elements.
    - 3) Exploratory demolition and concealed conditions.
  - d. Coordination of demolition work with work of other contracts.
  - e. Review shoring and bracing procedures, and structural load limitations of existing structure.
  - f. Review of site use, staging, and storage locations for salvaged materials and materials for recycling program.
  - g. Emergency weather protection procedures and weather limitations.
  - h. Review conditions of existing construction to be demolished.
  - i. Review structural load limitations of existing structure.
  - j. Review extent and location of selective demolition. Review areas where existing construction is to remain and requires protection
  - k. Review special requirements for temporary protection of existing finishes and materials to remain.
  - l. Review requirements of work performed by other trades that rely on substrates exposed by demolition operations.
  - m. Procedures for processing field decisions.
  - n. Procedures for handling hazardous materials.
  - o. Review fire protection procedures for cutting torches, and other potentially hazardous operations.
  - p. Review general safety regulations and requirements for demolition work.
- C. Sequencing:
- 1. Coordinate and arrange with mechanical and electrical trades for their disconnecting, rerouting and maintenance of existing services in the buildings as required, as part of the work of this Contract.
- D. Scheduling:
- 1. Comply with all requirements of this contract relative to protection, scheduling, phasing, and coordination with the Owner.

## 1.7 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Schedule: Prior to commencement of work, prepare a schedule indicating proposed methods and sequence of operations for demolition work.
    - a. Include coordination for shut-off, capping, and continuation of utility services as required, together with details for dust and noise control protection.

- b. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations. Receive acceptance from Architect prior to commencing work.
  - 2. Shop drawings: Indicate demolition sequencing and locations of salvageable items.
  - 3. Design Data: Submit calculations for bracing and shoring, signed and sealed by professional engineer registered in the State of New York
  - 4. Permits: Submit copy of permits required by regulatory agencies for demolition.
  - 5. Special Procedure Submittals: Submit copies of written agreements from private landowners, landfill operators, or other agencies accepting disposal of demolished materials at least two weeks prior to commencement of demolition work.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- 1. Record Documentation: Indicate actual location of capped site utilities.

#### 1.8 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for demolition work, safety of structure, dust control, and disposal of debris. Conform to procedures applicable when discovering hazardous materials or contaminated substances.
- B. Obtain and pay for required permits and licenses required from authorities prior to commencing demolition work. Arrange and pay for legal disposal of removed materials and equipment, obtain proper disposal receipts for verification.
- C. Notify affected utility companies and Owner before starting work and comply with utility company requirements.
- D. Do not close or obstruct egress width to exits. Do not disable or disrupt building fire or life safety systems without 3 days prior written notification to the Owner.

#### 1.9 QUALITY ASSURANCE

- A. General: Conduct the work in a manner giving prime consideration to protection of the public; protection from the weather, control of noise, shocks and vibration; control of dirt and dust; orderly access for and storage of materials; protection of existing buildings; protection of adjacent surfaces and property; coordination and cooperation with the Owner at all times.
  - 1. Comply with all requirements of this contract relative to protection, scheduling and coordination with the Owner.
- B. Qualifications:
  - 1. Demolition subcontractor: Company specializing in performing work of this section with minimum 3 years documented experience.
  - 2. Shoring and bracing design: Design shoring, and bracing, under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.10 SITE CONDITIONS

- A. Comply with wind and weather conditions established at pre-demolition meeting.

**PART 2 - PRODUCTS** (Not Used)

**PART 3 - EXECUTION**

3.1 EXAMINATION

- A. Condition of Structures: Owner assumes no responsibility nor makes any claim as to the actual condition or structural adequacy of any existing construction to be demolished. The Contractor shall investigate and assure himself of the condition of the work to be demolished and shall take all precautions to ensure safety of persons and property.
1. Notify both Owner and Architect, if any type of hazardous chemicals, gases, explosives, flammable material, unmarked containers, or similar dangerous substances are discovered. Cease work in affected areas until directed by Architect. Continue work in other areas.
- B. The Contractor shall have examined the existing conditions per requirements of the Conditions of the Contract and Division 1 - General Requirements, and reviewed Contract Documents prior to commencement of demolition. Coordinate and verify scope of selective demolition with other portions of work specified in other sections, and under separate Contract. Change orders will not be issued for the removal of any exposed to view materials or equipment, which are either indicated on the Drawings for removal, or not indicated, but necessary to remove for the Work of this Project.

3.2 PREPARATION

- A. General: Provide necessary protection of non-work areas during demolition operations. Provide, erect and maintain temporary barriers as required to protect non-construction related pedestrian and vehicular traffic using the adjacent portions of the site and building.
1. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy of adjacent facility.
- B. Protect existing structures which are not to be demolished. Protect designated materials and equipment to be removed and retained by Owner.
1. Cover or otherwise protect as necessary existing equipment, furniture and furnishing located beyond the immediate demolition work.
  2. Protect existing landscaping materials, structures, and appurtenances which are not to be demolished.
- C. Prevent movement of structure; provide required bracing and shoring.
1. Protect existing active utility services and structures from damage during selective demolition work including during installation of bracing and removal of same. Repair or replace damages to satisfaction of Owner.

- D. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations.

### 3.3 GENERAL REQUIREMENTS FOR SELECTIVE DEMOLITION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas, in compliance with governing laws and buildings, with prime consideration given to the safety, protection and convenience of the public and Owner's personnel.
  - 1. Maintain protected egress and access to the Work at all times.
- B. Perform selective demolition in an orderly and careful manner. Carefully cut materials to be removed to eliminate damage to portions to remain. Protect existing structure designated to remain.
  - 1. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
  - 2. Except as otherwise required by Project phasing requirements, proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 3. Locate equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 4. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent. Do not throw trash from windows or from roof.
  - 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - 6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  - 7. Pull nails and fasteners which remain after removal of attached material. Remove lath, strapping and other substructures associated with finishes to be removed.
  - 8. Where existing finishes are indicated to be removed, remove down to bare subsurface without causing damage to the subsurface.
    - a. After removal of non-asbestos finish flooring materials, remove underlying mastic and prepare substrate to receive new flooring materials by Shot Blasting method. Create a uniform 20 mil profile. Mechanically scarify areas which cannot be profiled by shot blast method. Thoroughly wash all flooring substrate and leave clean and dry ready for application of new flooring materials.
- C. Remove foundation walls and footings as indicated on Drawings, and where indicated, to a minimum of two feet beyond area of new construction.
- D. Cutting openings and holes: Neatly cut openings and holes plumb, square, and true to dimensions required. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces. Use cutting methods least likely to damage construction to remain or adjoining construction.

Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces.

1. All penetrations in floors and roof shall be framed with miscellaneous metal work prior to cutting and demolition of deck and concrete.
  2. Repair damage done to existing elements of building to remain, except repairs specified to be provided under other Sections. Repairs shall be done in such manner as to closely match construction, appearance and quality of original work.
- E. Use of cutting torches:
1. Do not use cutting torches until work area is cleared of flammable materials.
  2. Maintain adequate ventilation when using cutting torches.
  3. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations.
  4. Maintain fire watch and portable fire-suppression devices during flame-cutting operations. Comply with fire prevention measures specified under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- F. Carefully observe existing structure during demolition operations, cease operations immediately if structure appears to be in danger. Immediately notify both Architect and Owner's Project Representative. Do not resume demolition operations until directed.
- G. Disconnect, cap and clearly identify designated utilities within demolition areas.
1. Cap and remove abandoned existing utilities back to locations indicated, or to limit line of Contract where terminations are not indicated.
    - a. Pipes to be demolished that require a connection shall be removed to the extent required to install the new connection. Remove pipe sections by saw-cutting, removing a complete pipe section to an existing joint, or other adequate means which results in a clean joint.
  2. Protect and maintain conduits, drains, sewers, pipes, and similar utilities that are not to be demolished
- H. Disconnect existing equipment and fixtures to be removed, or services abandoned, and piping, wiring, and conduit which would otherwise be exposed in the finished work. Remove from site disconnected equipment and fixtures and piping not to be reused.
1. Contractor to remove and dispose of all equipment not tagged or scheduled for reuse.
- I. Abandoned Equipment, Utilities, Systems: Remove in their entirety. Abandonment in place is not acceptable, except where an item is specifically indicated to be abandoned in place.
1. "Abandoned" means the item is not operational in the completed Contract.
  2. Without limitation, remove abandoned pipes, tubing, conduits, wires, cables, ducts, equipment, machines, and all elements and items related to abandoned work including, without limitation, hangers, connectors, anchors, valves, drains, strainers, sumps, panels, mounting boards, grounding rods, ground



connectors, boxes, dampers, plenums, insulation, escutcheons, trims, and all other related items.

3. Where an existing element is indicated to be abandoned in place, the abandoned item shall be cut off and, if hollow, capped.
  - a. Cut off sufficiently below the finished plane to permit space for patching over the abandoned element. The Contractor shall provide all cutting and chipping required to recess the cut element, and to coordinate depth of cut-offs required for finishing.

#### 3.4 BRACING

- A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace. Provide suitable bracing materials which will support loads imposed
- B. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to Architect.
- C. Install internal bracing, if required, to prevent spreading or distortion to braced frames.
- D. Maintain bracing until structural elements are rebraced by other bracing or until permanent construction is able to withstand designed live and dead loads.
- E. Remove bracing in stages to avoid disturbance or damage to existing structure.
- F. Repair or replace adjacent work damaged or displaced through installation or removal of bracing work.

#### 3.5 EXPLORATORY DEMOLITION AND CONCEALED CONDITIONS

- A. Exploratory Demolition and Concealed Conditions:
  1. Selective demolition work includes controlled exploratory demolition work which is indicated on Drawings and as may be additionally field directed by the Architect. Additional exploratory demolition may also be required to thoroughly investigate and determine the exact location of existing concealed work or to expose concealed conditions to view.
  2. Exploratory demolition may be used to clarify the Contract Documents to improve the interface of new and existing work.
- B. Concealed conditions: Carefully check for concealed structure, pipes, conduits, wires, utilities, systems, and other elements before beginning cutting and selective demolition work.
- C. Discovery: When unknown, concealed utilities and systems are discovered, verify the purpose, routing, circulation, origin, and termination of these items.
  1. If the unknown, concealed items are part of a system to be abandoned, remove the item in its entirety.
  2. Protect discovered concealed items are part of an existing system to be preserved and incorporated into the Work, or part of an active system to remain. Protect system elements from disturbance and notify both Owner and Architect and follow the Architect's directions

- a. In circumstances when existing system to remain is damaged due to the Work (including cutting, demolition or exploratory investigation) notify both Owner and Architect immediately. Repair or re-route the damaged system components as directed by the Architect at no additional cost to the Owner

### 3.6 GENERAL DUST CONTROL

- A. Contractor shall employ dust and pollution prevention procedures at all times. Compliance with requirements for dust protection and air quality control is required for work areas which abut Owner occupied areas. Dust removal and periodic cleaning requirements apply to all work. Contractor shall employ dust and pollution prevention procedures so that a healthy Owner's environment is fully maintained at all times. Compliance with the requirements in Division One for dust control is mandatory and may not be compromised at any point during construction.
  1. Clean up loose debris daily, or more frequently as required, to prevent the wind spreading debris. Keep dumpsters covered when not in use.
  2. Cover handcarts carrying debris being transported through Owner occupied areas.
  3. Wet down debris (as appropriate) to prevent air pollution by dust rising from demolition work. Wet down dumpsters to prevent fires caused by vandals.
  4. Employ tarpaulins on all trucks carrying debris.

### 3.7 SALVAGE MATERIALS AND PRODUCTS

- A. Carefully salvage and provide safe storage for products designated for salvage, reuse, as indicated on the Drawings, as specified herein, or as requested by Owner for reuse on the project, or to be stored for Owner's future use. Take particular care with finished items and items requiring special handling.
  1. Remove items indicated to be salvaged with extreme care to prevent damage.
  2. All components and parts of salvaged items shall be saved and packaged.
- B. Removed and Salvaged Items:
  1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area as designated by Owner.
  5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
  1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.8 SELECTIVE DEMOLITION REQUIREMENTS FOR MATERIALS AND SURFACES.

- A. Remove designated at-grade paving, curbs, gutters, sidewalks, access ramps, and driveways. Remove entirely to limits indicated, provide saw-cut where abutting existing-in-situ paving designated to remain. Comply with requirements of Division 31 – EARTHWORK.
  - 1. Where adjacent pavement or concrete designated to remain is broken or deteriorated sufficiently to prohibit a sound replacement, remove the entire deteriorated section to limit determined by the Architect/Engineer.
- B. Floors, General:
  - 1. Completely remove existing flooring located in areas scheduled to receive new flooring surfaces and as additionally indicated. Remove all finish flooring layers of flooring down to the existing substrate.
    - a. Completely remove flooring systems to substrate, including full removal of all setting beds and adhesives.
  - 2. Remove resilient flooring and adhesive in strict accordance with the technical bulletin entitled " Recommended Work Practices for the Removal of Resilient Floor Covering", as issued by Resilient Floor Covering Institute (RFCI).
  - 3. Patching: The Contractor is responsible for patching of flooring substrates and subfloors. Respective finish flooring trades are responsible for patching of finish flooring systems matching abutting surface.
- C. Walls, General:
  - 1. Remove interior walls and partitions as indicated and as needed to accommodate new work.
  - 2. Where existing walls-to-remain are indicated to receive new finishes, completely remove trim and fasteners.
  - 3. Patching: The Contractor is responsible for patching of substrates and back-up systems. Finishes work shall be provided under individual product specification sections.
- D. Doors and Frames: Where doors and frames are indicated to be removed from walls or partitions which are to remain, remove doors and frames carefully so as to minimize damage to wall. Repair and patch wall as necessary to accommodate new door frame or other new work.
- E. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to Section 07 54 23 for roofing requirements.
  - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
  - 2. Remove existing roofing system down to substrate.

- F. Concrete, General: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.
- G. Concrete Slabs (suspended and slabs-on-grade): Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- H. Masonry: Demolish in small sections. Except where toothing is required, cut masonry using power-driven saw at junctures with construction to remain. Remove masonry between saw cuts.
- I. Elevator Equipment: Completely remove all elevator equipment associated with elevators as indicated, including but not limited to, cab, platform, rails, hoistway entrances, machines, and cables. Perform all work as required by code and local authorities having jurisdiction in regards to such work. Refer to Division 14 for additional requirements.
- J. Fire Suppression and Sprinkler Equipment: Fire Protection subcontractor is responsible to disconnect, cap and lower to floor items required to be removed, including but not limited to piping, hangers, valves, and insulation.
- K. Plumbing Equipment: Plumbing subcontractor is responsible to disconnect, cap and lower to floor items required to be removed, including but not limited to fixtures, equipment, water heaters, piping, hangers, valves, and insulation.
- L. Heating, Ventilation, Air Conditioning, and Refrigeration (HVAC&R) Equipment:
  - 1. Drain system components designated for disposal of all lubricants, hydraulics, and refrigerants without releasing into atmosphere.
  - 2. HVAC&R subcontractor(s) shall disconnect, cap and lower to floor items required to be removed, including but not limited to, ductwork, piping, fans, VAV boxes, unit ventilators, and all similar system equipment. Contractor is responsible for removal from site and proper disposal.
- M. Electrical Equipment and Lighting Fixtures:
  - 1. Electrical subcontractor(s) shall disconnect, cap and lower to floor items required to be removed, including but not limited to, panelboards, light fixtures, and overhead devices including, fire alarm, intercom, bus ducts. Contractor is responsible for removal from site.

### 3.9 REPAIRS

- A. Repair all damage done to elements of buildings and structures to remain, except repairs specified to be provided under other Sections, or as indicated for removal in subsequent project phase(s). Repairs shall be done in such manner as to closely match construction, appearance and quality of original work.

### 3.10 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated or specified to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove

demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL, and specified waste diversion goals.
  2. As work progresses, regularly remove demolished materials from site. Do not allow demolished materials to accumulate on-site, except as required for materials determined to be reused, salvaged, or as required for waste segregation and diversion for recycling.
  3. As work progresses, regularly remove demolished materials from site. Do not allow demolished materials to accumulate on-site, except as required for materials determined to be reused, salvaged, or as required to comply State of New York regulations on specific banned materials prohibited from incineration or landfill disposal.
  4. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  5. Liquid Waste Management: Dispose of liquid waste in accordance with all applicable regulations. Consult all regulations (federal, provincial, state, local) or a qualified waste disposal firm when characterizing waste for disposal. Contact manufacturer for MSDS sheets for product information, and recommendations for proposal disposal. Utilize licensed waste disposal companies as may be required.
- B. Do not burn or bury demolished materials on site, arrange for legal disposal of the same.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.
1. Comply with waste management reporting requirements on forms acceptable to the Owner. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
  2. Comply with waste management reporting requirements on forms acceptable to the Owner.
  3. Record the amount (in tons or cubic yards) of material landfilled from the Project, the identity of the landfill, the total amount of tipping fees paid, transportation costs (if separate) and the total disposal cost. Include manifests, weight tickets, receipt, and invoices

### 3.11 CLEANING

- A. Daily cleaning: Sweep all street and roads affected by demolition operations.
- B. Upon completion of the work of this Section; remove unused tools and equipment, surplus materials, rubbish, debris, and dust. Leave area in raked or broom-clean condition, as appropriate.
- C. Upon completion of the work of this Section; clean adjacent structures and facilities of dust, dirt and debris caused by demolition work to the satisfaction of Owner, owner(s) of adjacent properties, and authorities having jurisdiction.

End of Section

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**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. All provisions, terms, and conditions of the Contract including all bid documents, specifications, drawings, addenda, and other contract documents.

1.2 DEFINITIONS

- A. Many key words appear throughout the design documents and New York State Department of Labor (NYS DOL) Industrial Code Rule 56 (ICR 56).
- B. Definitions of these key words are provided to assist in the understanding of the design documents (see Appendix A: Definitions).

1.3 PRE-BID CONFERENCE

- A. A pre-bid conference will be conducted by the Construction Manager and Project Designer (AECC). At the pre-bid conference, the Contractor shall acknowledge that they understand the scope of work for this project and the terms / conditions as to how the asbestos abatement work is to be completed on this project.
- B. A work area walkthrough will be conducted as part of the pre-bid conference for the Contractor to satisfy themselves with the site and the scope of work to be performed on this project. Failure to understand the scope of work shall not relieve the Contractor from completing the work, as specified and scheduled.

1.4 SCOPE OF WORK

- A. In general, the scope-of-work for this abatement project includes the work described in the table below:

<b>Abatement Work Area Location</b>	<b>Asbestos Abatement Scope of Work Description</b>	<b>Approximate Quantity</b>
Accessible Sections of Crawlspace  <u>Reference Drawings</u> HM0.00, HM1.00 & HM2.00	<b>Pipe and/or Pipe Fitting Insulation and Pipe and/or Pipe Insulation Debris</b> - Removal and disposal of asbestos-containing pipe and pipe insulation debris. All work shall be performed as an asbestos cleanup project under an approved New York State Department of Labor-approved Site Specific Variance.	2,850 LF Pipe/Fitting Insulation & 4,400 SF Associated Debris
Inaccessible Sections of Crawlspace  <u>Reference Drawings</u> HM0.00, HM1.00 & HM2.00	<b>Pipe and/or Pipe Fitting Insulation and Pipe and/or Pipe Insulation Debris</b> - Removal and disposal of asbestos-containing pipe and pipe insulation debris. All work shall be performed as an asbestos cleanup project under an approved New York State Department of Labor-approved Site Specific Variance. *Due to sections of the crawlspace being inaccessible, the indicated quantities for these areas are assumptions based on the original plumbing drawings.	1,800 LF Pipe/Fitting Insulation & 14,400 SF Associated Debris

<b>Abatement Work Area Location</b>	<b>Asbestos Abatement Scope of Work Description</b>	<b>Approximate Quantity</b>
<p>1<sup>st</sup> Floor  Room 1140   <u>Reference Drawings</u>  HM1.00</p>	<p><b>Pipe Fitting Insulation Debris</b> - Removal and disposal of asbestos-containing pipe fitting insulation debris. The affected portion of the suspended ceiling system shall be removed under abatement conditions and disposed of as RACM. All work shall be performed as an asbestos cleanup project under a New York State Department of Labor-approved Site Specific Variance.</p>	<p>4 SF</p>
<p>1<sup>st</sup> Floor – 6<sup>th</sup> Floor  Above Ceilings &amp;  Inside Wall Chases  Throughout Building   <u>Reference Drawings</u>  HM1.00, HM2.00,  HM3.00, HM4.00,  HM5.00 &amp; HM6.00</p>	<p><b>Pipe and/or Pipe Fitting Insulation</b> - Removal and disposal of asbestos-containing pipe and/or pipe fitting insulation. Where present above suspended or hard ceiling system (plaster, sheetrock, etc.), selective demolition of ceiling shall occur under abatement conditions. Where present within wall cavities, selective demolition shall occur under abatement conditions. If pipe and/or pipe fitting insulation debris are discovered during selective demolition, then all waste shall be disposed of as RACM. Locations of pipe and/or pipe fitting insulation above hard ceilings and within wall chases are based on the original plumbing drawings (1927). Actual locations and quantities may vary from the drawings.</p>	<p>25,000 LF</p>
<p>1<sup>st</sup>, 2<sup>nd</sup> &amp; 3<sup>rd</sup> Floor  Various Rooms &amp;  Corridors   <u>Reference Drawings</u>  HM1.00, HM2.00 &amp;  HM3.00</p>	<p><b>Floor Tile</b> – Removal and disposal of asbestos-containing floor tile, and associated non-asbestos-containing cove base. Where present, carpeting, casework/cabinet bases, unit ventilators, shelving, or other fixed feature, those items shall be removed under abatement conditions to allow removal of underlying floor tile. If tile extends beneath a wall or other structural component that is to remain, tile shall be cut flush with the vertical plane of the wall, and exposed edge shall be sealed with encapsulant.</p>	<p>5,350 SF</p>
<p>1<sup>st</sup> Floor – 6<sup>th</sup> Floor  Various Rooms &amp;  Corridors   <u>Reference Drawings</u>  HM1.00, HM2.00,  HM3.00, HM4.00,  HM5.00 &amp; HM6.00</p>	<p><b>Cork Floor Mastic</b> - Removal and disposal of non-asbestos cork floor cove base, cork floor tile, floor filler compound, and underlying asbestos-containing cork mastic to clean substrate. Where present, carpeting, casework/cabinet bases, unit ventilators, shelving, or other fixed feature, those items shall be removed under abatement conditions to allow removal of underlying cork mastic.</p>	<p>88,775 SF</p>
<p>2<sup>nd</sup> Floor  Room 2127   <u>Reference Drawings</u>  HM2.00</p>	<p><b>Cork Floor Mastic (beneath wood flooring)</b> - Removal and disposal of non-asbestos wood flooring, cork floor tile, floor filler compound, and underlying asbestos-containing cork mastic to clean substrate.</p>	<p>15 SF</p>
<p>1<sup>st</sup> Floor  Rooms 1109, 1139,  1140, 1140A, 1141,  1142 &amp; 1144   <u>Reference Drawings</u>  HM1.00</p>	<p><b>Ceiling Tile Mastic</b> - Removal and disposal of non-asbestos-containing ceiling tile and associated asbestos-containing ceiling tile mastic to clean substrate. Where present above suspended ceiling system, remove ceiling under abatement conditions.</p>	<p>3,875 SF</p>



<b>Abatement Work Area Location</b>	<b>Asbestos Abatement Scope of Work Description</b>	<b>Approximate Quantity</b>
1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> & 5 <sup>th</sup> Floor Various Locations  <u>Reference Drawings</u> HM1.00, HM2.00, HM3.00 & HM5.00	<b>Heater Insulation Board</b> - Removal and disposal of asbestos-containing heater insulation board. Remove any cabinetry, coverings, wall boxes, grilles, dampeners, etc. as necessary to remove the insulation board in its entirety under abatement conditions.	2,600 SF
2 <sup>nd</sup> Floor Stair 2007  <u>Reference Drawings</u> HM2.00	<b>Fire Door Insulation</b> - Removal and disposal of asbestos-containing fire door assembly in its entirety.	32 SF
2 <sup>nd</sup> Floor Rooms 2411, 2415 & 2413  <u>Reference Drawings</u> HM2.00	<b>Interior Door Caulk</b> - Removal and disposal of asbestos-containing interior door caulk to clean substrate.	6 SF
2 <sup>nd</sup> Floor Room 2426  <u>Reference Drawings</u> HM2.00	<b>Window Glazing Compound</b> - Removal and disposal of stored windows with asbestos-containing window glazing compound in its entirety.	4 SF
2 <sup>nd</sup> Floor Room 2336  <u>Reference Drawings</u> HM2.00	<b>Sidelight Window Glazing Compound</b> - Removal and disposal of a door sidelight with asbestos-containing glazing compound in its entirety.	2 SF
1 <sup>st</sup> & 3 <sup>rd</sup> Floor Stair 3008 & 2003  <u>Reference Drawings</u> HM2.00 & HM3.00	<b>Door Vision Panel Glazing Compound</b> - Removal and disposal of a door with asbestos-containing vision panel glazing compound in its entirety.	2 SF
2 <sup>nd</sup> Floor Corridor 2052  <u>Reference Drawings</u> HM2.00	<b>Door Caulk And Door Vision Glazing Compound</b> - Removal and disposal of asbestos-containing door caulk and door vision glazing compound to clean substrate.	3 SF
1 <sup>st</sup> & 2 <sup>nd</sup> Floor Rooms 1112, 1114, 1157A & 2423  <u>Reference Drawings</u> HM1.00 & HM2.00	<b>Wall and/or Pipe Penetration Sealant</b> - Removal and disposal of asbestos-containing wall and/or pipe penetration sealant to clean substrate.	21 SF

<b>Abatement Work Area Location</b>	<b>Asbestos Abatement Scope of Work Description</b>	<b>Approximate Quantity</b>
<p>2<sup>nd</sup> Floor  Corridor 2051</p> <p><u>Reference Drawings</u>  HM2.00</p>	<p><b>Vermiculite Insulated Drinking Fountain</b> - Removal and disposal of a vermiculite insulated drinking fountain in its entirety.</p>	<p>6 SF</p>
<p>1<sup>st</sup> Floor – 5<sup>th</sup> Floor  Assumed Within North and South Incinerator Shafts</p> <p><u>Reference Drawings</u>  HM1.00, HM2.00, HM3.00, HM4.00 &amp; HM5.00</p>	<p><b>Incinerator Patching Compound</b> - Removal and disposal of asbestos-containing patching compound from two incinerator shafts to clean substrate.</p>	<p>1,200 SF</p>
<p>1<sup>st</sup> Floor – 6<sup>th</sup> Floor  Various Locations</p> <p><u>Reference Drawings</u>  HM1.00, HM2.00, HM3.00, HM4.00, HM5.00 &amp; HM6.00</p>	<p><b>Electrical Components</b> – Removal and disposal of presumed asbestos-containing electrical system components. Owner to de-energize and disconnect power to all components. Abatement contractor to verify with owner that such disconnection has been completed, and verify absence of energy in all components to be removed.</p>	<p>160 SF</p>
<p>1<sup>st</sup> &amp; 2<sup>nd</sup> Floor Rooms  1226 &amp; 2412</p> <p><u>Reference Drawings</u>  HM1.00 &amp; HM2.00</p>	<p><b>Elevator Components</b> - Removal and disposal of presumed asbestos-containing elevator components in their entirety.</p>	<p>20 SF</p>
<p>Exterior of Building</p> <p><u>Reference Drawings</u>  HM1.00, HM2.00, HM3.00, HM4.00, HM5.00 &amp; HM6.00</p>	<p><b>Window Glazing Compound</b> - Removal and disposal of asbestos-containing window glazing compound to clean substrate.</p>	<p>1,310 SF</p>
<p>Exterior of Building</p> <p><u>Reference Drawings</u>  HM2.00, HM3.00 &amp; HM8.00</p>	<p><b>Transite Drain Pipe</b> - Removal and disposal of asbestos-containing transite drain pipe.</p>	<p>10 SF</p>
<p>Exterior of Building</p> <p><u>Reference Drawings</u>  HM8.00</p>	<p><b>Sanitary Sewer Pipe</b> - Removal and disposal of presumed asbestos-containing sanitary sewer pipe.</p>	<p>60 LF</p>

Abatement Work Area Location	Asbestos Abatement Scope of Work Description	Approximate Quantity
Exterior of Building <u>Reference Drawings</u> HM3.00	<b>Roofing Cement</b> - Removal and disposal of asbestos-containing roofing cement from metal covering to clean substrate.	20 SF
Roofing System Reference Drawing Drawings <u>Reference Drawings</u> HM-7.00	<b>Roofing Materials</b> - Removal and disposal of all layers of asbestos-containing cement patching compound on slate roofing tiles, chimney caulk around chimney, roofing cement around exhaust units, and caulk on slate roofing, to clean substrate.	170 SF

**Table Notes:**

SF = Square Feet  
 LF = Linear Feet

*\*Important Table Note: By submitting a bid on this project, the Contractor acknowledges that the types, locations, and quantities of ACM listed in the tables are approximate and shall be field-verified. Variations of ±20% in the quantities listed above shall be acknowledged by the Contractor and shall be reflected in the base bid fee for this project. Payment for work will be based upon actual quantities removed at the unit prices stated on the Bid Form, and will be added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.*

- C. The Contractor's pricing shall include costs for all labor, materials, equipment, asbestos project notifications and associated fees, insurance, waste transportation and disposal, overhead and profit, and all other costs necessary to complete the work as specified.
- D. The Contractor shall address any questions about the work of this project during the pre-bid conference and up until submission of bid. The Contractor must be satisfied and agreeable to the design plans and specifications upon the submission of their bid.
- E. All work shall be performed in accordance with the project design specifications and all applicable federal, state, and local regulations. If conflicts occur between the project design documents and federal, state, and/or local regulations, the most stringent requirement shall apply. The Contractor shall comply with the following, except where more stringent requirements are shown or specified:
  - 1. Federal Regulations:
    - a. OSHA 29 CFR Part 1910.1001 - Asbestos
    - b. OSHA 29 CFR Part 1910.1200 - Hazard Communication
    - c. OSHA 29 CFR Part 1910.134 - Respiratory Protection
    - d. OSHA 29 CFR Part 1910.145 - Specification for Accident Prevention Signs and Tags
    - e. OSHA 29 CFR Part 1926 - Construction Industry
    - f. OSHA 29 CFR Part 1926.1101 - Asbestos, Tremolite, Anthophyllite, and Actinolite
    - g. OSHA 29 CFR Part 1926.500 - Guardrails, Handrails, and Covers
    - h. USEPA 40 CFR Part 61, Subpart A - General Provisions

- i. USEPA 40 CFR Part 61, Subpart M - Asbestos NESHAPs
  2. New York State Regulations:
    - a. NYSDOL 12 NYCRR Part 56 - "Asbestos" as amended 3/21/2007
    - b. NYSDEC 6 NYCRR Parts 360 and 364 - Waste Disposal & Transportation
    - c. NYSDOH 10 NYCRR Part 73 - Asbestos Safety Program Requirements
  3. All Local Regulations
  4. Standards and Guidance Documents:
    - a. American National Standard Institute (ANSI) Z88.2-80, Practices for Respiratory Protection
    - b. ANSI Z9.2-79, Fundamentals Governing the Design and Operation of Local Exhaust Systems
    - c. USEPA 560/585-024, Guidance for Controlling Asbestos Containing Materials in Buildings (Purple Book)
    - d. USEPA 530-SW-85-007, Asbestos Waste Management Guidance
  5. All Building, Fire Code, and Local regulations.
- F. The Contractor accepts that multiple means of clearance criteria will be utilized for final clearance purposes based upon the applicable regulatory requirements or conditions set forth within the NYSDOL-approved site-specific variances. Visual inspections, Phase Contrast Microscopy (PCM), and/or Transmission Electron Microscopy (TEM) analysis of air samples will be utilized for clearance purposes on this project, as required.

#### 1.5 INSURANCE REQUIREMENTS

- A. Contractor shall be responsible for meeting the insurance requirements set forth by the Building Owner.
- B. Contractor shall not proceed with any work activities until the Building Owner and Construction Manager have approved the insurance certificates provided by the Contractor.

#### 1.6 BUILDING OWNER RESPONSIBILITIES

- A. The Building Owner shall be responsible for:
  1. Hiring an independent, third-party asbestos project monitoring / air sampling firm.
  2. Providing a source of electrical power for the Contractor to perform asbestos abatement activities.
  3. Providing a source of water for the Contractor to perform asbestos abatement activities.

#### 1.7 CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall be responsible for:
  1. Performing the asbestos abatement work in accordance with all applicable federal, state, and local regulations including, but not limited to: all New York State, United States Environmental Protection Agency (USEPA), and Occupational Safety and Health Administration (OSHA) codes, rules, regulations, and standards.

2. Providing portable / temporary sanitary facilities at the project site for the duration of project work activities.
3. Providing and maintaining secured / controlled access to restricted and regulated work areas for the duration of project-related activities.
4. Providing supervisors and workers who are competent, trained, and medically fit to conduct the asbestos abatement work as well as all materials and equipment necessary to satisfactorily complete the work.
5. Collecting personal exposure assessment air samples for their employees, as required by applicable OSHA standards. The third-party Project Monitor / Air Sampling Technician shall not perform or be responsible for the collection, shipping / delivery, or analysis of the Contractor's personal exposure assessment air samples on this project.
6. Completing the project as specified by the design documents. The Contractor accepts that the asbestos abatement work is not complete until satisfactory final visual inspections are made and after clearance air testing results are deemed to be acceptable and the project-related wastes have been removed from site.
7. Packaging, transporting, and disposing of all asbestos (regulated and non-regulated) wastes generated by the work in accordance with all applicable federal, state, and local regulations.
8. Ensuring restricted and regulated work area security during the course of the project, so that unauthorized personnel do not enter restricted and/or regulated work areas.
9. Providing emergency plans and emergency telephone numbers to on-site abatement personnel. The emergency plans and telephone numbers shall be kept on site at all times during the project.
10. Obeying the Building Owner's policies and procedures pertaining to work on-site.
11. Ensuring that no employee of their company speaks to the media without written permission from the Building Owner.
12. Complying with the contractual requirements set forth by the Building Owner.
13. Posting a notice at all building entrances notifying all persons of the Contractor's intent to conduct asbestos abatement work ten (10) days prior to starting any project-related activities.
14. Notifying the NYSDOL and USEPA about the asbestos abatement work and paying the applicable project notification fees.
15. Following the direction of the Building Owner, Construction Manager, and Project Designer with respect to schedule, health / safety issues, and other site activities. The Contractor shall be responsible for the legal means and methods of performing the work of the project in accordance with their contract.

#### 1.8 PERSONAL PROTECTIVE EQUIPMENT

- A. The Contractor shall be responsible for providing their personnel with adequate personal protective equipment (PPE) to perform work activities on this project, as per the applicable federal and state regulations.
- B. The Contractor will be responsible for collecting OSHA personal asbestos samples for their workers on this project. Representative samples shall be taken daily and sample results shall be posted at the personal decontamination unit within forty-eight (48) hours of

collection. The Contractor is responsible for providing their employees with adequate respiratory protection based upon the sample results received.

- C. Street clothing is not permitted inside regulated work areas during abatement activities.
- D. The Contractor is responsible for providing the Project Designer, the Project Monitor, any regulatory personnel, and/or authorized visitors with PPE upon demand, and at no cost. This may include some or all of the following: protective clothing, respirators, high efficiency particulate air (HEPA) cartridges, hard hats, gloves, eye protection, and rubber disposable boots.

#### 1.9 SUBMITTALS

- A. Qualification Submittals - By submitting a bid for the work on this project, the Building Owner, Construction Manager, and/or Project Designer may undertake investigations (as necessary) to select the most qualified contractor for this project. If requested by any of the aforementioned parties, the following information shall be submitted to the Project Designer (three hard copies) for review, prior to contract award:
  - 1. Contractor's Asbestos Handling License issued by the NYSDOL.
  - 2. A notarized statement, signed by an officer of the company, containing the following information:
    - a. Any federal, state, or local regulatory agency citations, violations, notices, orders to comply, or penalties recorded against the asbestos abatement contractor in the last three (3) years.
    - b. Any claims or legal proceedings in which the Contractor has been involved in the past three (3) years.
    - c. Any OSHA fines and/or citations, and a list of OSHA recordable accidents per year for the last three (3) years.
    - d. Any asbestos related projects where a contract has been terminated, including project name, client, dates, and reasons for termination.
  - 3. A minimum of five (5) project references for projects similar in nature to this project that have been self-performed and completed in the past three (3) years including the project name and location, scope of work, client, and contact person's name, telephone number, and e-mail address.
  - 4. Failure to submit this information upon request may result in the disqualification and dismissal of the Contractor's bid. By submitting a bid on this project, the Contractor understands and accepts this requirement.
- B. Pre-Work Submittals - The Contractor shall submit the following information to the Project Designer at least ten (10) business days prior to the commencement of work activities at the project site:
  - 1. Contractor's Asbestos Handling License, issued by the NYSDOL.
  - 2. NYSDOL Asbestos Project Notification.
  - 3. USEPA Notification of Demolition & Renovation.
  - 4. Asbestos Project Notice to be posted on each building / structure prior to the start of the work, as required by ICR 56-3.6.
  - 5. New York State Department of Environmental Conservation (NYSDEC) Waste Transporter Permit.

6. NYSDEC landfill permit(s) where asbestos waste from the site will be disposed.
  7. Project schedule showing daily activities, phases of work, and regulated work areas including, but not limited to: mobilization, work area preparation, abatement / removal, cleanings, work area dismantlement, and demobilization.
  8. Wastewater discharge permit required by state, county, or local municipality. If a permit is not required or will not be obtained, submit a written statement describing how wastewater from this project will be collected and disposed. Contractor shall be responsible for verifying discharge procedures with the Local authority, prior to submission of bid.
  9. Safety Data Sheets (SDS) for all chemicals, solvents, products, and materials utilized on the project.
  10. Manufacturer's specifications/certifications for all materials and equipment utilized on the project.
  11. Written notifications to local fire, rescue, and emergency agencies informing them of the nature and schedule of the work at the site.
  12. List of contact persons and emergency phone numbers for Contractor personnel to be posted at the project site.
  13. Asbestos abatement personnel / worker documentation, including:
    - a. NYSDOL Asbestos Handling Certificates.
    - b. NYSDOH 2832 Asbestos Training Certificates.
    - c. Medical examinations/evaluations.
    - d. Respirator fit test certifications
  14. The Contractor shall not proceed with any work until the pre-work submittals have been approved by the Project Designer.
- C. Work Submittals - The Contractor shall submit the following information to the Project Designer during the course of the project:
1. OSHA personal exposure assessment air sampling data. The Building Owner, Construction Manager, Project Designer, and Project Monitor are not responsible for the interpretation of these results. The intent is only to show that the Contractor is collecting these samples, as required by OSHA.
  2. A daily list of the personnel on-site accompanied by their NYSDOL Asbestos Handling Certificate number.
- D. Post-Work / Project Closeout Submittals - Before final payment is made by the Building Owner, the following information shall be submitted by the Contractor to the Project Designer for review within 30 days after completing work activities:
1. Copies of all waste disposal manifests, disposal logs, and weight tickets. All original waste disposal records shall be submitted directly to the Building Owner by the Contractor within ten (10) calendar days of the waste leaving site.
  2. Copies of the Supervisor's daily project log, as required by ICR 56-7.3, documenting all pertinent events that occur throughout the project, which include the following:
    - a. Elevated air sampling result(s) shall be noted along with the time of the work cessation, results of barrier and negative air system inspection, and a summary of any necessary repairs and the required cleaning(s).
    - b. Manometer readings documented twice per work shift.

- c. Daily (including days without work shifts) inspection results of negative-air ventilation system and any necessary repairs, if applicable.
  - d. Daily (including days without work shifts) inspection results of HVAC system positive pressurization and any necessary repairs, if applicable.
  - e. Daily (including days without work shifts) inspection results of any critical / isolation barriers and any necessary repairs, if applicable. Inspections shall be performed twice per work shift on days where work is performed.
  - f. Daily testing of barriers and enclosures as per ICR 56-8.2(f) and any necessary repairs, if applicable.
  - g. Daily cleaning of decontamination system enclosures to be documented at the end of each work shift.
  - h. Results of each visual inspection and time of each intermediate completion, if applicable.
  - i. Results of visual inspection by Supervisor and Project Monitor for each asbestos abatement work area prior to clearance air sampling.
3. Entry / exit logs for each asbestos abatement regulated work area.
  4. Final NYSDOL and USEPA project notifications, as applicable.
  5. Any other submittal requested by the Building Owner, Construction Manager, and/or Project Designer.
  6. The Construction Manager and Project Designer shall ensure that the Contractor has met all the contractual obligations to close out this project. Failure to provide all of the requested project closeout documentation may result in the delay of payment to the Contractor. The Contractor shall not be entitled to any additional compensation or finance charges caused by their failure to submit the requested closeout information in a timely manner.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS & EQUIPMENT**

- A. The Contractor shall be responsible for:
  1. Providing all materials and equipment necessary to complete work activities.
  2. Providing safe / reliable materials and equipment.
  3. Providing appropriate PPE for all abatement personnel.
  4. Providing HEPA-filtered air filtration devices and HEPA vacuums.
  5. Providing continuous negative air pressure within the regulated work area for the duration of abatement activities, until which time final air samples meet clearance criteria.
  6. Utilizing barrier tape and danger signs to keep unauthorized personnel away from the restricted and regulated work areas. Danger signs shall contain the following language:

**DANGER  
CONTAINS ASBESTOS FIBERS  
AVOID CREATING DUST  
CANCER AND LUNG DISEASE HAZARD**
  7. Utilizing airless sprayers to limit airborne dust / particulate within the regulated work area.



8. Utilizing flame-retardant 6-mil polyethylene sheeting for the construction of abatement work areas, decontamination units, and the lining of waste containers.
  9. Utilizing 6-mil polyethylene bags for the containerization of asbestos wastes.
  10. Utilizing duct tape or approved equivalent to seal polyethylene sheeting and waste disposal bags.
  11. Utilizing electrical equipment and power cords in compliance with all applicable OSHA standards.
  12. Utilizing Ground Fault Interrupters (GFIs) or Ground Fault Circuit Interrupters (GFCIs) on all power sources.
- B. Any miscellaneous products not covered in this specification must have written approval from the Project Designer, prior to use on-site.
- C. Any miscellaneous products used at the site must be accompanied by manufacturer's product information and a safety data sheet (SDS). This information must be submitted to the Project Designer prior to the products arriving on site. The Contractor may not proceed until the products have been approved for use by the Project Designer.

### **PART 3 - EXECUTION**

#### **3.1 UTILITIES**

- A. For asbestos abatement activities, the Building Owner shall provide the Contractor with power and water sources; however, the Contractor shall be responsible for all interconnects, hoses, wires, etc.
- B. All temporary water and electrical service connections / installations shall be conducted by a licensed plumber / electrician and be installed accordance with all applicable federal, state, and local codes, rules, and regulations.
- C. The Contractor shall be responsible for the maintenance of all electrical cords and water hoses, and keeping them in a secure location to prevent unnecessary tripping and/or slipping hazards.
- D. The Contractor is responsible for verifying that all utilities have been properly isolated or terminated, as required to perform work activities, prior to the start of the project-related activities.
- E. Contractor shall be responsible for providing electrical power, as needed, to the Project Monitor / Air Sampling Technician for the collection of all project-related air samples, including power for the collection of background and final air samples.

#### **3.2 DECONTAMINATION FACILITIES**

- A. All decontamination facilities shall meet the requirements of ICR 56 and shall be constructed and deemed adequate by the Project Monitor, prior to the commencement of any work area prep activities.
- B. The personal decontamination unit shall be equipped with one (1) shower per six (6) full-shift abatement workers.

- C. Decontamination units shall be cleaned at the beginning, during and end of each work shift. Dirt and/or debris in the decontamination unit shall not be permitted.

### 3.3 HEATING, VENTILATION & AIR CONDITIONING (HVAC) SYSTEMS

- A. The Contractor shall shutdown / isolate, de-energize, and seal all HVAC systems to complete abatement activities on this project.

### 3.4 NEGATIVE PRESSURE VENTILATION

- A. Negative air pressure shall be provided and installed that, at a minimum, complies with the provisions within the NYS DOL-approved site-specific variance.
- B. Negative air pressure shall be continuous for the duration of the project until final air clearance criteria have been achieved. HEPA vacuums may only be utilized for negative air pressure on minor-sized abatement work areas.
- C. Manometers shall be used to document the pressure differential for all OSHA Class I large and small sized friable regulated work areas. A minimum of -0.02 column inches of water pressure differential, relative to pressure outside the regulated work area, shall be maintained within the regulated work area, as evidenced by manometric measurements. Once installed, on a daily basis and at least twice per work shift, the Contractor shall document the manometer readings in the daily project log. The manometer shall be installed and made operational once negative air ventilation has been established in the regulated work area. At a minimum, magnahelic manometers shall be calibrated semi-annually, and a copy of the current calibration certification shall be posted at the work site, as required by ICR 56.
- D. The Contractor shall be responsible for the following:
  - 1. Monitoring of negative air pressure equipment and records of the daily manometer readings in the Supervisor's project log book.
  - 2. Stoppage of activities when negative air pressure is lost or is less than required. The Contractor shall not resume activities until constant negative air pressure is has been reestablished and maintained for at least 30 minutes.

### 3.5 CRITICAL / ISOLATION BARRIERS

- A. After pre-cleaning activities are completed, the Contractor shall install critical and isolation barriers as per ICR 56 or the conditions found within the NYS DOL-approved site-specific variances.
- B. Two (2) layers of 6-mil polyethylene sheeting shall be utilized to cover and seal windows, doors, openings, drains, ducts, corridors, etc. to isolate the work area from other areas of the building.
- C. All critical / isolation barriers shall be smoke-tested and the results of these inspections recorded in the Supervisor's daily project log book.
- D. The Contractor shall inspect all critical / isolation barriers during the abatement project, as required by ICR 56 requirements, to ensure that the barriers remain in-place and in good condition.

### 3.6 PRE-CLEANING ACTIVITIES

- A. Pre-cleaning activities will be required prior to work area preparation, as per ICR 56 or the conditions found within the NYSDOL-approved site-specific variances.
- B. The Contractor shall request a visual inspection by the Project Monitor to ensure that the work areas have been successfully pre-cleaned, prior to commencement of work area preparation activities.

### 3.7 ASBESTOS HANDLING & CLEANING ACTIVITIES

- A. The Contractor shall conduct all asbestos removal / abatement activities in accordance with ICR 56 or the conditions found within the NYSDOL-approved site-specific variances.
- B. Negative air machines shall be utilized at all regulated work areas, until satisfactory air sample results have been achieved. HEPA vacuums may only be utilized to provide continuous negative air pressure ventilation on minor-sized abatement projects.
- C. All asbestos materials shall be removed using wet methods. Dry removal, sweeping, wire brushing, use of pressurized water / pressurized air, or other inappropriate techniques will not be permitted.
- D. Airless sprayers shall be utilized to control airborne asbestos fiber concentrations.
- E. The Contractor is responsible for taking appropriate measures to reduce nuisance odors and noise from migrating to other areas of the building.
- F. Waste shall be immediately bagged and be transported to the waste decontamination enclosure. Waste bags shall then be cleaned in the waste decontamination enclosure, double bagged, labeled, and transported to the waste dumpster, trailer, etc.
- G. Waste bag transfer shall take place inside a cart that has been lined with two (2) layers of 6-mil polyethylene sheeting. This cart shall also be covered by polyethylene during any waste transfer activities and be labeled with appropriate asbestos signage.
- H. As required, workers shall wear PPE during work area preparation, abatement activities, cleaning, and during any other work area activities until final air clearance criteria has been achieved.
- I. The Contractor shall be responsible for providing the Project Monitor / Air Sampling Technician with sufficient power to conduct air sampling at the project site. The Contractor shall also provide the Project Monitor / Air Sampling Technician with access to the decontamination unit and hot water on days when final / clearance air sampling is required (even when abatement work is not taking place).

### 3.8 WASTE DISPOSAL ACTIVITIES

- A. The Contractor shall ensure that all asbestos waste / debris are sufficiently wet, prior to being bagged / containerized for disposal.
- B. Bags, drums, or other acceptable packages / containers used for asbestos waste shall be labeled with appropriate asbestos waste generator tags / labels.

- C. Two (2) 6-mil polyethylene bags or two (2) layers of 6-mil polyethylene sheeting shall be utilized for the disposal of all asbestos waste.
- D. A daily count of asbestos waste bags, drums, containers, etc. shall be recorded by the Supervisor. This count shall be provided to the Project Monitor each day.
- E. All asbestos and other wastes from the site shall be sent to a properly permitted landfill or disposal facility. Waste manifests shall accompany all asbestos and all regulated wastes that are removed from the site. All original waste manifests shall be submitted directly to the Building Owner and shall not be given to the General Contractor, Project Designer, or Project Monitor.
- F. Vehicles used for the transport of all wastes shall bear all appropriate permit tags, markings, and placards.

### 3.9 INSPECTIONS

- A. The Contractor shall not interfere, impede, or delay any inspections by the Building Owner (or their authorized visitors), Construction Manager, Project Designer, Project Monitor, or any federal, state, or local inspectors.
- B. The Contractor shall request inspections from the Project Monitor at the following intervals, as applicable to the project:
  - 1. Upon completion of the decontamination system enclosure.
  - 2. Upon completion of the restricted / regulated work area.
  - 3. Upon completion of the abatement / final cleaning process.
  - 4. Upon completion of teardown / dismantling activities.
- C. The Supervisor shall be responsible for adequately documenting inspections in their daily project log book.

### 3.10 ASBESTOS PROJECT MONITORING / AIR SAMPLING

- A. The Contractor shall not include any costs in their bid for project monitoring or air sampling activities.
- B. The Project Monitor / Air Sampling Technician will be responsible for the following:
  - 1. Conducting air sampling, in accordance with ICR 56 or the conditions found within the NYS DOL-approved site-specific variances.
  - 2. Conducting a visual inspection for completeness of abatement and completeness of cleanup as per the provisions of the current ASTM Standard E1368 - "Standard Practice for Visual Inspection of Asbestos Abatement Projects." An entry shall be made into the daily project log by both the Supervisor and the Project Monitor performing the inspection, detailing the findings of the visual inspection. The full name and NYS DOL asbestos handling certificate number of the certified Project Monitor performing the inspection shall also be documented in the Supervisor's daily project log.
  - 3. Performing aggressive air sampling techniques during final clearance air sampling.

- C. The Contractor understands that the Project Monitor has been retained by the Building Owner to oversee the asbestos abatement project and that the Building Owner has authorized the Project Monitor to stop the Contractor's work if the Contractor is not following the contract documents, design specifications, applicable codes, rules, regulations, and/or the conditions found within the NYSDOL-approved site-specific variance. Work shall only be permitted to commence if allowed by the Building Owner and the Project Designer after corrective actions have been made. The Contractor acknowledges that it is their responsibility to follow all applicable laws pertaining to asbestos abatement and job specifications, and failure to do so may result in lost time and/or dismissal from site at no cost to the Building Owner, Construction Manager, Project Designer, or Project Monitor. The Contractor shall not be compensated for any lost time, labor, materials, etc., due to inappropriate actions or behaviors.

End of Section

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## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. All provisions, terms, and conditions of the Contract including all bid documents, specifications, drawings, addenda, and other contract documents.

### 1.2 DEFINITIONS

- A. Lead-based paint (LBP), as defined by the U.S. Environmental Protection Agency (USEPA) and the U.S. Department of Housing and Urban Development (HUD), means paints / varnishes or glazed materials (i.e. ceramic tile) containing 0.5% lead or more by weight.
- B. Lead, as defined by OSHA 29 CFR Part 1926.62 means: metallic lead, all inorganic lead compounds, and organic lead soaps. All other organic lead compounds are excluded from this definition.
- C. Action Level, as defined by OSHA 29 CFR Part 1926.62, means employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter ( $30 \mu\text{g}/\text{m}^3$ ) of air calculated as an 8-hour time-weighted average (TWA).
- D. Permissible Exposure Limit (PEL), as defined by OSHA 29 CFR Part 1926.62, means employee exposure, without regard to personal protective equipment, to an airborne concentration of lead of  $50 \mu\text{g}/\text{m}^3$  (calculated as a TWA).
- E. Competent person, as defined by OSHA 29 CFR Part 1926.62, means one who is capable of identifying lead hazards and implementing corrective measures to eliminate hazards.
- F. Lead-containing material (LCM) includes LBP, lead-containing components, lead-lined walls and surfaces, and ceramic tile applications. A building material is defined as a LCM if any detectable amount of lead is present in that building material.

### 1.3 SUMMARY OF WORK

- A. Due to the age of the building / structure, all untested painted surfaces and building materials shall be presumed to contain lead and shall be treated as LCM in accordance with federal, state, and local regulations.
- B. Any activity that will disturb LCM shall comply with the conditions specified herein. The Occupational Safety & Health Administration (OSHA) regulates occupational exposure to lead under 29 CFR Part 1926.62, Lead in Construction Standard. Any Contractor disturbing LCM shall comply with all the requirements of 29 CFR Part 1926.62 and this specification. The intent is for the Contractor to protect their workers, building occupants, and the general public from unnecessary exposures to lead.
- C. The Contractor shall provide all labor, materials, tools, equipment, and engineering controls necessary to protect their workers, building occupants, and the general public from exposure to lead.

- D. Any waste products shall be considered industrial or hazardous waste, based on the results of a Toxicity Characteristic Leaching Procedure (TCLP) test. If required by the landfill receiving the wastes from this project, the costs related to the TCLP sampling / laboratory analysis shall be the sole responsibility of the Contractor and included in their base bid fee for the project.
- E. Exact quantities and locations of the LCM to be disturbed shall be determined by the Contractor prior to their submission of bid.
- F. All work shall be performed in accordance with this specification and applicable federal, state, and/or local regulations. Dry sweeping of demolition dust containing lead is strictly prohibited. Lead-containing debris must be picked up utilizing a high-efficiency particulate air (HEPA) vacuum system, designed to collect LCM, debris, and dust.
- G. It is the Contractor's responsibility to ensure that waste materials are contained, transported, and disposed of in accordance with all applicable federal, state, and local regulations.

#### 1.4 APPLICABLE REGULATIONS

- A. The Contractor shall comply with all federal, state, and local laws, ordinances, rules, and regulations regarding the handling, transportation, storage, and disposal of LCM. The Contractor is further responsible to conduct all work activities in strict compliance with all applicable codes, rules, laws, and regulations including, but not limited to:
  - 1. Worker Protection / Building Occupant Protection - Occupational Safety & Health Administration (OSHA)
    - 29 CFR Part 1910.134 - Respiratory Protection Standard
    - 29 CFR Part 1926. 20 - General Safety and Health Provisions
    - 29 CFR Part 1926.59 - Hazard Communication
    - 29 CFR Part 1926.62 - Lead Exposure in Construction
    - 29 CFR Part 1910.94 and Part 1926. 57 - Ventilation
  - 2. Ambient Air Quality- Environmental Protection Agency (EPA)
    - 40 CFR Part 50.6 - National Primary and Secondary Ambient Air Quality Standards for Particulate Matter
  - 3. Water Quality - Environmental Protection Agency (EPA)
    - 40 CFR Part 122 - Administered Permit Programs; The National Pollutant Discharge Elimination System
  - 4. Waste Disposal - Environmental Protection Agency (EPA)
    - 40 CFR Part 261 - Identification and Listing of Hazardous Waste
    - 40 CFR Part 262 - Standards Applicable to Generators of Hazardous Waste
    - 40 CFR Part 263 - Standards Applicable to Transporters of Hazardous Waste
  - 5. New York State Department of Environmental Conservation (NYSDEC)
    - Title 6 Parts 360-7, 364, and 370 through 374



- B. The Contractor shall also comply with the following regulations and guidance documentation:
  - 1. U.S. Department of Labor
  - 2. Occupational Safety and Health Administration Pub. 3126 - Working with Lead in the Construction Industry

#### 1.5 LEAD HAZARDS

- A. Work practices / methods that may release lead dust or fumes into the air and onto surrounding surfaces are strictly prohibited. It is the Contractor's responsibility to prevent potential exposures to lead.
- B. Lead is a toxic substance, which travels into the body by inhalation or ingestion due to lead dust and/or fumes that are present. Upon entering the body, lead enters the bloodstream, traveling throughout the body. The body cannot eliminate all of the lead; therefore, it is stored in tissue and organs. Stored quantities of lead may cause irreversible damage to cells, organs, and body systems.
- C. Exposure to lead affects individuals differently. Exposure may occur without any indication of exposure or symptoms developing. Symptoms of lead poisoning to be aware of include, but are not limited to, loss of appetite, trouble sleeping, irritability, fatigue, headache, joint and muscle ache, metallic taste, decreased sex drive, lack of concentration, and moodiness.
- D. Prolonged exposure may result in damage to the body's systems including nervous, reproductive and circulatory systems. Symptoms of such exposures may include, but are not limited to, stomach pains, high blood pressure, nausea, tremors, seizures, anemia, constipation, and convulsions.
- E. The Contractor's Supervisor is responsible to monitor any workers for such symptoms and is further responsible for ensuring affected workers are removed from the area. Affected workers shall not return until such time that the requirements outlined in the OSHA Lead in Construction Standard (29 CFR Part 1926.62) have been met.

#### 1.6 GENERAL REQUIREMENTS

- A. The Contractor is responsible for complying with the following general requirements applicable to the project (at a minimum):
  - 1. Respiratory protection and personnel protection
  - 2. Medical examinations.
  - 3. Utilization of engineering controls, as necessary, to reduce potential exposure.
  - 4. Proper clean-up and disposal of all lead related waste materials, as required.
- B. The Contractor is solely responsible for properly protecting their workers. Additional safety measures beyond OSHA requirements are encouraged, but are at the implementation and discretion of the Contractor.

## 1.7 SUBMITTALS

- A. Prior to commencement of any activities with the potential to disturb LCM, the Contractor shall submit the following documentation:
  - 1. Work Plan - The Contractor shall submit a work plan in compliance with the requirements of the OSHA Lead in Construction Standard. The plan shall include but is not limited to: handling / removal, cleaning, containerizing, transport, and disposal activities.
  - 2. Equipment - Information for all equipment utilized shall be submitted for review prior to commencement of project activities. This includes, but is not necessarily limited to: manufacturer specifications and safety data sheets (SDS).
  - 3. Training - The Contractor shall provide proof of Lead Awareness training in accordance with OSHA 29 CFR Part 1926.62 for all employees that shall perform work on this project.
  - 4. Disposal - The Contractor shall submit documentation including all required permits, anticipated waste hauler information, and the anticipated disposal location (assuming the waste is non-hazardous).

## 1.8 PERSONAL AIR SAMPLING & ANALYSIS

- A. The Contractor is responsible for conducting personal air sampling for their employees as required by OSHA 29 CFR Part 1926.62. This includes daily 8-hour TWA sampling. Personal air sampling shall be required on this project, regardless of any previous negative exposure assessment data.
- B. If requested by the Building Owner, Construction Manager, or Project Designer, the Contractor shall prove that they are conducting OSHA personal lead exposure assessment air sampling of employees by providing laboratory results upon request.

## 1.9 CLEARANCE CRITERIA

- A. The Building Owner shall retain a third-party Environmental Consultant to observe LCM removal activities, as part of the asbestos abatement process. Based upon the scope of work to be performed and use of the building (commercial offices), visual clearance measures shall suffice for clearance purposes.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Solutions - A lead-specific cleaning solution shall be utilized for all cleaning activities. The cleaning solution shall be an approved solution that does not contain tri-sodium phosphate (TSP).
- B. Plastic Sheeting - To prevent dust migration during demolition activities, dust barriers, containments and/or enclosures shall be constructed utilizing 6-mil fire-retardant polyethylene sheeting. These barriers shall be installed to prevent dust migration outside of the regulated work area. Since this work shall be performed as part of any asbestos abatement project, the critical / isolation barriers

shall need to be compliant with New York State Industrial Code Rule 56 regulations.

- C. Framing - If framing is utilized during the construction of any dust barriers or containments, all reinforcement framing / sheathing materials must be at least  $\frac{3}{8}$ -inch thick. Minimum requirements for framing materials shall be comprised of 2"x4" stud framing in accordance with all applicable building codes.
- D. Adhesives - Commercially available duct tape and spray adhesives designed for such purposes are allowed to maintain the integrity of any barriers, containments, and/or enclosures erected.

## 2.2 EQUIPMENT

- A. Protective Clothing - Coveralls, gloves, eye protection, ear protection, safety footwear, hard hats, and fall protection are required as per all applicable OSHA regulations. The Contractor is responsible for supplying all such equipment and including these costs in their pricing.
- B. Respiratory Protection - The Contractor shall provide workers with adequate respiratory protection based on the lead hazards identified at the site. The amount of respiratory protection provided to the workers shall be determined by conducting personal air sampling.
- C. Respirator Filters - The Contractor shall provide their workers with appropriate respirator filters for the respiratory protection the workers are utilizing as per OSHA regulations.

## PART 3 - EXECUTION

### 3.1 LEAD COMPLIANCE PLAN

- A. The Contractor is required to establish and follow a lead compliance plan for the project. The requirements, as outlined in OSHA 29 CFR Part 1926.62, include written procedures for construction activities with regard to control methods and engineering controls.
- B. If the Contractor fails to follow their lead compliance plan, the Building Owner may elect to hire a third-party consultant to specifically oversee the Contractor's compliance plan and any selective demolition-related activities. The cost for the third-party consultant shall be deducted from the Contractor's base bid fee.

### 3.2 SIGNAGE

- A. Warning signs shall be posted in all areas where the potential for any lead exposure exists. Signs shall remain in place until demolition activities have been completed and the area cleaned.
- B. All signage shall comply with OSHA 29 CFR Part 1926.62.

### 3.3 WORK METHODS

- A. The Contractor shall select work methods in compliance with OSHA 29 CFR Part 1926.62. All work shall be performed utilizing wet methods and other engineering controls, as necessary.
- B. The Contractor is prohibited from dry methods of removal, heat gun applications, mechanical methods (grinding / sanding), and/or torch-cutting lead-based paint during demolition-related activities.

### 3.4 CLEANING ACTIVITIES

- A. Following the completion of all LBP / LCM removal activities, all surfaces within 25 feet of the disturbed material shall be adequately cleaned of all visible paint chips and paint chip debris / dust.
- B. If the Contractor does not satisfactorily clean an area after demolition or removal activities, the affected areas shall be re-cleaned by the Contractor at their own expense. The cost for re-cleaning, third-party consultant oversight, and/or additional sampling / testing associated with re-cleaning activities shall be borne by the Contractor.

### 3.5 WASTE DISPOSAL

- A. The Contractor shall be responsible for properly containerizing all of the waste materials associated with the removal of LCM. Waste materials include, but are not limited to the following: personal protective equipment, plastic sheeting, signage, barrier tape, LCM components, and associated materials.
- B. The Contractor is responsible to coordinating the interim storage of waste containers at the project site with the Building Owner and Construction Manager.
- C. Lead paint chips and/or lead paint debris shall not be comingled with regular demolition debris. Failure to do shall result in the Contractor having to pay the associated fees for comingled lead waste disposal.

### 3.6 PROJECT CLOSEOUT

- A. The Contractor shall provide copies of all OSHA personal / employee lead exposure assessment air sampling data collected during the course of completing the work.
- B. Failure to provide any close-out documentation shall result in the delay of payment to the Contractor.

End of Section

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. All provisions, terms, and conditions of the Contract including all bid documents, specifications, drawings, addenda, hazardous material pre-demolition survey reports, and other contract documents.

1.2 SUMMARY OF WORK

- A. The scope of work includes the handling, packaging, containerization, characterization, transportation, and disposal of all the miscellaneous hazardous / special wastes from the project site. In general, the miscellaneous hazardous / special wastes to be properly handled and disposed of on this project include, but are not necessarily limited to:

**Table 1: Miscellaneous Hazardous / Special Waste Inventory**

MISCELLANEOUS ITEM	ITEM LOCATION	ESTIMATED COUNT	PRESUMED HAZ MATERIAL	ITEM CONDITION
In-Service Fluorescent Light Bulbs	Throughout Building	1,300	Mercury	Intact
Stored Fluorescent Light Bulbs	Storage Room 2427	200	Mercury	Intact
In-Service Light Ballasts	Throughout Building	650	PCBs	Intact
Stored Light Ballasts	Storage Room 2427	20	PCBs	Intact
Exit Signs (Bulbs & Batteries)	Corridors Throughout Building	130	Mercury & Lead	Intact
Interior Emergency Flood Light Batteries	Various Locations Throughout Building	10	Lead	Intact
In-Service Thermostats	Various Locations Throughout Building	40	Mercury	Intact
In-Service Bulb Thermometers	Mechanical Room 1109	2	Mercury	Intact
Smoke Detectors (Batteries)	Rooms & Corridors Throughout Building	650	Lead	Intact
Fire Extinguishers	Throughout Building	60	Compressed Gas / Chemicals	Intact
Elevator Oils	Elevator Room 1226 & Elevator Room 2412	N/A	Petroleum Compounds and/or PCBs	Intact

**Table 1: Miscellaneous Hazardous / Special Waste Inventory**

MISCELLANEOUS ITEM	ITEM LOCATION	ESTIMATED COUNT	PRESUMED HAZ MATERIAL	ITEM CONDITION
Air Conditioning Units	Various Locations Throughout Building	20	Freon	Intact
Household Cleaning Products	Various Janitor Closets & Storage Rooms	400	VOCs	Intact
Solvents / Paints	Storage Room 2426 & Maintenance Room 2418	20	VOCs, Lead	Intact
Automotive Liquids	Maintenance Room 2418	10	Petroleum Compounds	Intact
Electronic Scrap	Storage Room 1156	200	Metals	Intact
Compressed Gas Cylinders	Mechanical Room 1109	1	Compressed Gas / Chemicals	Intact
Compressor	Mechanical Room 1109	1	Petroleum Compounds	Intact
Pumps	Mechanical Room 1109	2	Petroleum Compounds	Intact
Small Motors	Mechanical Room 1109	2	Petroleum Compounds	Intact

- B. Due to the potential presence of hazardous wastes and/or regulated materials, these waste materials may not be disposed of as construction and demolition (C&D) debris. The Contractor shall comply with all applicable federal, state, and local regulations when characterizing, handling, packaging, containerizing, transporting, and disposing of these wastes.
- C. If any spills or releases of hazardous or regulated material occurs, the Contractor shall notify the District and District Representatives immediately and take all necessary precautions and measures to contain and cleanup such spills or releases in accordance with all applicable regulations.
- D. The Contractor shall ensure that their workers are properly trained and protected during all miscellaneous hazardous / special waste handling and disposal operations.
- E. The Contractor is responsible for following all applicable federal, state, and local regulations. Failure to comply with regulations shall result in the Contractor having to pay for any legal fees, fines, cleanup costs, and/or other penalties associated with improper activities. If conflicts occur between any regulations and the project specifications, the Contractor is responsible for following the most stringent course of action.

1.3 SUBMITTALS

- A. The Contractor shall provide the following submittals prior to conducting any work activities at the project site:
  - 1. Proof of Training – In accordance with OSHA regulations, training must be provided to inform workers about the potential hazards associated with hazardous / special wastes prior to conducting operations at the project site. HAZMAT or HAZWOPER training certificates are recommended.
  - 2. Waste Container Information – Contractor shall provide documentation detailing the description of the waste containers that shall be utilized for all of the miscellaneous hazardous / special wastes during the course of this project.
  - 3. Waste Receiver Information – Contractor shall provide documentation pertaining to the proposed final destination of the special wastes and whether or not the wastes shall be disposed of or recycled.

#### 1.4 ENVIRONMENTAL CONSULTANT

- A. A third-party Environmental Consultant shall be hired by the Building Owner and oversee the Contractor during the handling / removal of the miscellaneous special wastes from the asbestos abatement work area. The Environmental Consultant will be responsible for the following tasks:
  - 1. Keeping a daily project log of the Contractor's activities on-site.
  - 2. Providing oversight of the Contractor.
  - 3. Recording the daily special waste removal count, as provided by the Supervisor.

### PART 2 – PRODUCTS

#### 2.1 MATERIALS

- A. Contractor shall only utilize proper NYSDOT / USDOT shipping containers to package and containerize waste products for disposal purposes.
- B. Raw vermiculite insulation shall not be utilized to package any miscellaneous special wastes, unless the Contractor has sufficient documentation to verify that the vermiculite insulation is asbestos-free. The documentation must be provided directly from the manufacturer and be provided to the Project Designer, prior to being delivered to the project site.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. The Contractor shall be responsible for the handling / removal, packaging, containerization, transportation, and disposal of all miscellaneous special wastes from the asbestos abatement work area.
- B. The Contractor shall provide all labor, materials, tools, equipment, and personal protective equipment (PPE) necessary to remove of all of the miscellaneous special wastes from the asbestos abatement work area.

#### 3.2 CLOSE-OUT DOCUMENTATION

- A. The Contractor shall provide the Environmental Consultant with quantities of all miscellaneous special wastes removed on a daily basis. This shall include a final summary at the conclusion of project activities.
  
- B. The Contractor shall provide the Project Designer with copies of all pertinent waste recycling / disposal documentation within thirty (30) days of completing project-related activities. Original waste recycling / disposal documentation shall be transmitted to the Building Owner directly by the Contractor within ten (10) days of the wastes leaving the project site.

End of Section



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Section 03 01 36

RESURFACING AND PATCHING OF CONCRETE SLABS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Grind down high spots in existing concrete surfaces to specified tolerances.
- B. Shot blast clean existing concrete slabs free of dirt, laitance, corrosion, or other contamination ready to receive finish flooring.
- C. Prepare substrates, level and patch existing concrete surfaces, and concrete surfaces damaged by the demolition Work of this Contract, including:
  - 1. Restore concrete surfaces after conclusion of demolition.
  - 2. Fill openings in suspended slabs where indicated.
  - 3. Patch concrete at slabs-on-grade where trenching has occurred.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION.
- D. Section 03 30 00 - CAST-IN-PLACE CONCRETE.
- E. Section 03 05 13 - CONCRETE SEALERS.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ACI 302 - Guide for Concrete Floor and Slab Construction.
  - 2. ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.
  - 3. ASTM C 33 - Concrete Aggregates.

4. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch Cube Specimens).
5. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
6. ASTM C 150 - Portland Cement.
7. ASTM C 348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
8. ASTM C 928 - Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
9. ASTM C 1708 – Self-leveling Mortars Containing Hydraulic Cements.

## 1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for proposed patching underlayment.
  2. Concrete Mix Test Reports: Submit Preliminary Design Mix Reports (ACI 301).
  3. Manufacturer's instructions: Manufacturer's preparation, mixing, priming, and application instructions.
  4. Shop drawings:
    - a. Patching and resurfacing scope drawings: 1/4-inch scale elevations and plans of areas covered by the Work of this Section.
    - b. Reinforcement shop drawings: Plans and details showing bar sizes, spacing, locations, depth of doweling, and quantities of reinforcing steel. Include schedules and diagrams to indicate beds, sizes and lengths of reinforcing members.
  5. LEED Submittal Requirements:
    - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
      - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
        - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
        - b) EPD shall have at least Cradle to Gate scope,
      - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
    - b. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
      - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
        - a) The exposure scenario used to determine compliance.
        - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;

Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more

- c) Laboratory accreditation under ISO/IEC 17025.
  - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
- 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.

## 1.6 QUALIFICATIONS

- A. Mixing and application equipment as approved by the manufacturer.

## 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of materials.
- C. Qualifications:
  - 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.
- D. Perform work to provide homogeneous concrete with required strength, durability, and without planes of weakness, and other structural defects, and free of air pockets, voids, projections, off sets of plane, and other defacements on exposed surfaces.

## 1.8 PRE-INSTALLATION CONFERENCE

- A. At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
  - 1. Required attendees: **Owner's representative**, Architect, General Contractor, Installer, manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
    - a. Section 02 41 19-Selective Demolition.
    - b. Section 09 30 00 - Tiling
    - c. Section 09 64 33 - Laminated Wood Flooring
    - d. Section 09 65 19 - Resilient Tile Flooring
    - e. Section 09 65 23 - Rubber Flooring
    - f. Section 09 65 43 - Linoleum Flooring
    - g. Section 09 65 66 - Resilient Athletic Flooring
    - h. Section 09 66 23 - Resinous Matrix Terrazzo Flooring

- i. Section 09 68 00 - Carpeting
- j. Section 09 68 13 - Tile Carpeting
- 2. Agenda:
  - a. Scheduling of resurfacing and patching operations.
  - b. Review of staging and material storage locations.
  - c. Coordination of work by flooring trades.
  - d. Establish weather and working temperature conditions to which Architect and Contractor must agree.
  - e. Discuss process for inspection and acceptance of completed Work of this Section.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.
- C. Storage and Handling Requirements:
  - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- D. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

#### 1.10 ENVIRONMENTAL CONDITIONS

- A. Do not place cementitious underlayment when ambient temperature is below freezing.
- B. When air temperature has fallen or is expected to fall below 40 degrees. F (4 degrees. C), heat water and aggregates before mixing to attain concrete at point of placement with temperature of 50 degrees F, 80 degrees F maximum.
- C. Do not place concrete underlayment on surfaces that are covered with standing water, snow, or ice.

### **PART 2 – PRODUCTS**

#### 2.1 DESCRIPTION

- A. General Description: Interior Work consisting of:

1. Cement and polymer-based, trowel applied underlayment and patching mortar, for conditions:
    - a. Feather to 1/2 inch thick.
    - b. 1/2 to maximum 1 inch thick.
  2. Portland cement concrete fill.
- B. Sustainability Requirements: Provide materials with maximum possible recycled content.

## 2.2 MANUFACTURERS

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on products of Silpro Corporation, Ayer MA.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Ardex Americas, Aliquippa PA.
  2. Bonsal American (Pro Spec), Charlotte NC.
  3. Silpro Corporation, Ayer MA.

## 2.3 UNDERLAYMENT AND PATCHING MORTAR

- A. General: Provide products that are compatible with flooring adhesives.
- B. Concrete resurfacing and underlayment for applications up to 1/2 inch thick: Factory blended portland cement-based product mixed with latex admixture, having the following performance characteristics:
1. Thickness Range: From feather edge to 1/2" maximum thickness.
  2. Working Time: At least 30 minutes at 70°F.
  3. Compressive Strength: ASTM C109, minimum 4,700 psi after 28 days.
  4. Tensile Strength: ASTM C190, minimum 1,040 psi after 28 days.
  5. Flexural Strength: ASTM C348, 1,560 psi after 28 days.
  6. Bond Strength to Concrete: ASTM C321, Crossed brick method, failure in concrete.
  7. Acceptable products:
    - a. Ardex: "SD-F Feather Finish".
    - b. Bonsal (Pro Spec): "Feather Edge".
    - c. Silpro: "Masco Underlayment and Repair Mortar with Silpro C21".
- C. Concrete resurfacing and underlayment for applications over 1/2 inch thick and up to 1 inch thickness: Factory blended portland cement-based product with latex admixture, having the following performance characteristics:
1. Thickness Range: From 1/2 inch to 1 inch maximum thickness. Provide without added aggregate, unless recommended by manufacturer for thickness required.

- a. Silpro: 1/2 to 3/4 inch without aggregate; use 3/8 inch pea stone for 3/4 to 1 inch thickness.
- b. Ardex: 1/2 inch to 1 inch without aggregate.
- c. Bonsal (Pro Spec): 1/2 inch to 1 inch without aggregate.
2. Working Time: At least 30 minutes at 70°F.
3. Compressive Strength: ASTM C109, minimum 6,000 psi after 28 days.
4. Tensile Strength: ASTM C190, minimum 710 psi after 28 days.
5. Flexural Strength: ASTM C348, minimum 1,200 psi after 28 days.
6. Shear Bond Strength: ASTM C1042, minimum 1,540 psi after 28 days.
7. Acceptable products:
  - a. Ardex: "SD-T".
  - b. Bonsal (Pro Spec): "Premium Patch 100".
  - c. Silpro: "Mascrete Topping and Structural Repair Mortar with Silpro C21".
- D. Water: Clean and potable.
- E. Primers: Unless otherwise recommended by underlayment and patching mortar manufacturer for substrate material, condition, and porosity encountered:
  1. Ardex: "P-51".
  2. Bonsal (Pro Spec): "118 Primer".
  3. Silpro: "C 21 All Acrylic".

#### 2.4 CONCRETE FILL MATERIALS

- A. Minimum compressive strength of slabs on grade, and topping slabs on metal deck: 3000 psi at 28 days, unless otherwise indicated on the structural Drawings.
- B. Maximum water to cement ratio: 0.45.
- C. Concrete Materials:
  1. Cement conforming to ASTM C 150, Type II - Normal.
  2. Fine aggregates conforming to ASTM C 33; natural sand.
  3. Course aggregates conforming to ASTM C 33; crushed stone or gravel.
  4. Water: Clean and potable.
- D. Concrete bonding agent: Two component epoxy bonding agent conforming with ASTM C881, Type 2.

#### 2.5 ACCESSORIES:

- A. Cleaning Agent: Commercial Muriatic acid.
- B. Perimeter Joint Filler: Glass fiber strips, compressible to 50 percent original thickness under load of 25 pounds per square inch with full recovery. Conforming to ASTM C612, Class 2.

2.6 MIXING

- A. Mix underlayment and patching mortars in strict compliance with manufacturer's written instructions. Do not overwater underlayment and patching mortars, do not retemper. Discard partially set underlayment and patching mortars which have not been placed.

2.7 SOURCE QUALITY CONTROL

- A. Manufacturer Services: Make arrangements to have Manufacturer's representative (employed by manufacturer) on-site during Work of this Section to periodically review installation procedures. A minimum of 3 site visits are required.

**PART 3 - EXECUTION**

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Beginning of installation means acceptance of existing conditions.
- B. The Contractor shall inspect and sound the areas involved to determine the full extent of the work involved and shall outline the limits of work involved using a marking crayon, paint or other suitable method for review by Architect.

3.2 PREPARATION - GENERAL

- A. Clean concrete surfaces of dirt, laitance, corrosion, or other contamination; wire brush using acid; rinse surface with clean water and allow to dry.
- B. Remove loose and friable materials from depressions and edges so new material bonds to sound existing construction.
- C. Flush out cracks and voids with Muriatic acid to remove laitance and dirt. Chemically neutralize by rinsing with water.
- D. Apply recommended number of coats of specified primer, at strength recommended for the substrate, by the primer manufacturer.
- E. Preparation for patching holes and depressions:
  - 1. Edges: Confirm edges are saw cut. Broken and fractured edges are not acceptable.
  - 2. Shape for slabs-on-grade: Confirm excavated shape has a greater surface area at the bottom than at the top to create a "dovetail slot" where the new concrete fill is mechanically locked.
  - 3. Shape for supported slabs: Confirm sound support and formwork at limits of placement.
- F. Where concrete patching, filling, or topping is required to "feather edge", saw cut a minimum 3/4 inch wide by 3/8 inch deep bonding channel in the concrete substrate at the point of feather edging.

### 3.3 RESURFACING WORK - GENERAL

- A. For spalling slab areas: Saw-cut around spalled areas to a depth of 1/2 to 3/4 inch. Angle bottom of saw cut away from spalled areas to provide keying. Chip out spalled area to saw cuts, chip area flat and level. Fill voids flush with surface with underlayment patching material.
- B. In locations where concrete is loose, chipped or missing to a depth of more than 3 inches; dowel stainless steel reinforcing into existing concrete. Drill holes in existing concrete equal to depth of repair; insert 1/4-inch diameter stainless steel dowels and pack solid with high-strength non-shrink grout.

### 3.4 FILLING WITH CONCRETE

- A. Install all framing, formwork and dowels required for the placing of concrete and for bonding new concrete to existing.
- B. Shortly before placing concrete, saturate the perimeter edges of the openings with water. After the free or glistening water disappears, the edges shall be given a thorough coating of neat cement slurry mixed to the consistency of thick paste and scrubbed in with a stiff bristle brush.
- C. Place mix and strike level with adjacent surfaces.
- D. Texture of finished concrete shall match that of existing abutting concrete.

### 3.5 APPLICATION - CONCRETE UNDERLAYMENT AND PATCHING MORTAR

- A. Surface Preparation:
  - 1. Clean substrate free of grease, wax, curing compounds and all other foreign materials. Substrates shall be solid and sound; remove all soft or crumbly materials.
  - 2. Make adhesion tests as recommended by manufacturer to ensure good bond to substrate. Acid etch polished floors. Completely strip sealed floors of existing sealer compounds.
  - 3. Prime subfloors as recommended by underlayment manufacturer, using the correct primer for porous and non-porous subfloors.
- B. Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this Section.
- C. Mix product directly from sealed package with water in proportions recommended by manufacturer. Where recommended by product manufacturer, add crushed stone aggregate and blend to dry mix prior to adding latex admixture. Avoid over watering.
- D. Apply underlayment and patching mortar while primer is still tacky. Place and trowel underlayment to the desired thickness. Do not use a power trowel. Steel trowel finish where underlayment will be a substrate for a finished flooring surface.
- E. If two or more layers of underlayment are applied, place second layer after first layer has set to walkable hardness.
- F. Where depressions occur, fill depressed area level with abutting surfaces.



- G. Install expansion joint filler at:
  - 1. Perimeter of placements.
  - 2. Around penetrations through decks.

### 3.6 TOLERANCES

- A. Installation Tolerances: The following allowable installed tolerances are allowable variations from locations and dimensions indicated by the Contract Document and shall not be added to allowable tolerances indicated for other work.
  - 1. Allowable Variation from True Level: 1/8" in 10'-0" when measured with a 10 foot long straight edge in all directions.

### 3.7 DEFECTIVE UNDERLAYMENT

- A. Defective underlayment and patching mortar: Defined as material not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Refinish or remove and replace underlayment and patching mortar surfaces that are too rough to receive finish flooring or where physical properties do not meet specified requirements.
- C. Repair or replacement of defective underlayment will be determined by the Architect.

End of Section

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Section 03 05 13  
CONCRETE SEALERS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install concrete sealers/coatings on exposed-to-view concrete floors where shown and as scheduled on the Drawings (designated CONC-1).

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE:
  - 1. Placing and finishing concrete slabs.
  - 2. Dustproofing concrete slabs exposed to view and substrate for carpet.
- D. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
  - 1. ASTM C156 – Water Retention by Liquid Membrane-Forming Curing Compounds for Concrete.
  - 2. ASTM C309 – Liquid Membrane-Forming Compounds for Curing Concrete.
  - 3. ASTM C1315 - Liquid Membrane-Forming Compounds, having Special Properties for Curing and Sealing Concrete

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, material compositions, and application instructions for all finishing products to be applied hereunder.
    - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all coatings.
  - 2. Samples of each level of slip resistance, aggregate, and pattern available in the specified products from the proposed manufacturer.

1.7 QUALITY ASSURANCE

- A. Use an applicator approved by the manufacturer, experienced in the approved materials, and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.8 ENVIRONMENTAL CONDITIONS

- A. Work shall be done only under optimum conditions as recommended by manufacturer. Surfaces over which sealer is to be applied shall be completely dry (minimum 30 days since concrete placement) and thoroughly clean. Maximum moisture content is 8 percent. Substrate and ambient temperature shall be between 60 and 90 degrees Fahrenheit (15 to 32 degrees Celsius).

1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  - 2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
- B. Storage and Handling Requirements:
  - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.

1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.
2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Transparent non-yellowing water-based acrylic sealer having a minimum of 15 percent solids, with a maximum VOC limit of 100 g/L. Subject to compliance with ASTM C309, Type 1, Class A, AASHTO M148, Type 1, Class B, and requirements specified herein.
  1. Products which may be incorporated in the work include the following, or approved equal:
    - a. Dayton-Superior, Miamisburg OH, product "Cure & Seal 309 (J18)".
    - b. Euclid Chemical Company, Cleveland OH., product "Aqua-Cure VOX."
    - c. Nox-Crete Inc., Omaha NE, product "Cure & Seal 150E".
    - d. Laticrete International Inc., Bethany CT, (L&M Construction Chemicals Brand), Omaha NE, product "Dress & Seal WB".

## **PART 3 - EXECUTION**

### **3.1 SURFACE PREPARATION**

- A. Upon acceptance of completed substrate surfaces, thoroughly remove all dust and debris by sweeping or vacuum cleaning.
- B. Remove laitance, curing sealers, existing adhesives and other foreign matter from concrete surfaces with necessary techniques such as shot blasting, Muriatic acid etching, surface freezing and power scarification.
- C. Surface preparation required if a curing compound has been applied to substrate surfaces.
  1. Thoroughly etch concrete surfaces using well mixed solution consisting of two parts by volume water diluted with one part by volume 30 percent commercial grade hydrochloric acid at a rate of one quart per ten square feet. Apply evenly to thoroughly saturated areas and scrub into surfaces using stiff-bristled broom. Allow solution to activate undisturbed for not less than five minutes or for duration of boiling effect.
  2. Thoroughly remove etching solution by washing down surfaces with clean water; flooded at least three separate times at a rate of two gallons per ten square feet; thoroughly remove all contaminants that may be engrained or latent in surfaces.
  3. Perform a test application of a square foot in three locations, such as beneath casework. Allow to set for 72 hours, and test adhesion as recommended by the manufacturer.

3.2 APPLICATION

- A. Apply sealer with manufacturer's recommended sprayer, at recommended rate of 400 square feet per gallon. Apply second coat when sealer is dry to touch. Allow sealer to cure undisturbed for a minimum period of 6 hours. Maintain temperature at 60 degrees Fahrenheit minimum until floor surfacing has completely dry.

End of Section

SECTION 03 30 00  
CAST IN PLACE CONCRETE

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes but is not limited to the following as shown on the drawings and as specified herein:
1. Foundation systems including footings, walls, beams, piers, pilasters, pits and similar concrete.
  2. Slabs on grade.
  3. Structural slabs on grade.
  4. Structural slabs on metal deck.
  5. Cast-in-place slabs, beams, walls, and columns.
  6. Topping slabs
  7. Stair pan fills.
  8. Furnishing and installing all required anchors and inserts.
  9. Placing in the forms all inserts, anchors, anchor bolts, bearing plates and the like furnished by other trades for casting into the concrete and cleaning of same after stripping of forms.
  10. Protection of all inserts, anchors, hangers, sleeves and supports furnished and set by others for the attachment of other work to the concrete, or required to permit the passage of other work through the concrete.
  11. Supply, fabricate and place all required reinforcing bars, mesh and other reinforcement for concrete where shown, called for, and/or required complete with proper supporting devices.
  12. Erection and removal of all formwork required to properly complete the work.
  13. Finishing of all concrete work as hereinafter specified.
  14. Curing and protection of all concrete work.
  15. Site concrete consisting of curbs, walls, pads, boxes and the like as shown on the drawings.
  16. Floor sealers and dust-proofing of all areas exposed and/or covered with carpet.
  17. Cutting, patching, grouting, repairing and pointing up as required.
  18. Vapor barrier system below slabs on grade.
  19. Under slab drainage course.
  20. Dewatering.
  21. Waterproofing.
  22. Grouting of all beam bearing plates and column base plates.
  23. Embedded plates in all foundation walls.
  24. Equipment pads as required.

25. All other work and materials as may be reasonably inferred and needed to make the work of this section complete.
26. Waste Management

B. Related Requirements:

1. Division 01 Section "Construction Waste Management Plan"
2. Division 01 Section "Sustainable Design Requirements"
3. Division 04 Section "Unit Masonry"
4. Division 05 Section "Structural Steel"
5. Division 05 Section "Metal Deck"
6. Division 05 Section "Metal Fabrications"
7. Division 06 Section "Rough Carpentry"
8. Division 07 Section "Waterproofing"
9. Division 07 Section "Joint Sealants"
10. Division 07 Section "Expansion Joint Cover Assemblies"
11. Division 31 Section "Dewatering"

1.3 SUSTAINABLE DESIGN REQUIREMENTS

- A. The Contractor is to implement practices and procedures to meet the Project's Sustainable Design goals, which include achieving LEED v4 Silver. The Contractor shall ensure that the requirements related to these goals, as defined in this Section and in Related Sections of the Contract Documents, are implemented. Substitutions, or other changes to the Work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the Project's Sustainable Design goals.
- B. Related Sections: Following description of work is included for reference only and shall not be presumed to be complete:
1. Provision of waste management: Section 017419, Construction Waste Management Plan.
  2. Provision of general LEED requirements and forms: 018113 Sustainable Design Requirements.
- C. The Contractor is to efficiently use resources and energy while executing the Work of this Section. Resource efficient aspects to be considered in completing this Project include the use of techniques that minimize waste generation, reuse of construction materials on site where possible, and recycling of waste generated during the construction process.
- D. Performance Requirements: The following criteria are required for the products included in this section
1. Preference shall be given to cast-in-place concrete containing raw materials harvested or extracted within 500 miles of the project site.
  2. All reinforcing steel, steel anchors, welded wire reinforcement, and other steel items required by the work of this section shall contain a minimum of 50% (combined) pre-consumer/post-consumer recycled content.



3. Adhesives, sealants, paints and coatings used for the work of this section shall meet the Volatile Organic Compound (VOC) limits specified in Section 018113 "Sustainable Design Requirements," where applicable.

E. LEED Performance Requirements:

1. Certification of recycled content, sourcing of materials, and VOC content shall be in accordance with the LEED Submittals requirements of this section.

1.4 LEED SUBMITTALS

A. Submit LEED Certification items as follows:

1. LEED Materials Certification Form: For all installed products and materials of this Section, complete the "Environmental Materials Reporting Form" (attached to end of Section 018113 "Sustainable Design Requirements"). Information to be supplied for this Form shall include:

- a. Cost breakdowns for materials included in the Contractor or sub-contractor's Work. Material cost does not include costs associated with labor and equipment.
- b. The percentages (by weight) of pre-consumer and/or post-consumer recycled content in the supplied product(s).
- c. Indication of whether the raw materials have been extracted, harvested or recovered, as well as the final product has been manufactured (location of final assembly), within 500 miles of the project site.

B. VOC Reporting Form: For all installed products and materials of this Section, complete the "VOC Reporting Form" (attached to end of Section 018113 "Sustainable Design Requirements"). Information to be supplied for this Form shall include:

1. Provide generic name by means of product type or application of all field-applied interior adhesives, sealants, paints, and coatings in this Section.
2. Provide corresponding referenced standard limits.
3. Provide full name of supplied product(s) and vendor or manufacturer for each product in this Section.
4. For all field-applied interior adhesives, sealants, paints, and coatings in this Section, provide Volatile Organic Compound (VOC) content in grams/liter or lbs./gallon.

C. Letters of Certification: Provided by the manufacturer on the manufacturer's letterhead, verifying the amount of recycled content.

D. Product Cut Sheets: For all materials that meet the sustainable design performance criteria as per the LEED Performance Requirements of this section.

E. Material Safety Data Sheets (MSDS): For all applicable products. Applicable products include, but are not limited to, adhesives, sealants, paints, and coatings applied to the interior of the building. MSDS shall indicate the Volatile Organic Compound (VOC)

content of products submitted. If an MSDS does not indicate VOC content, then product data sheets, manufacturer's literature, or certification letter indicating a product's VOC content can be submitted with the MSDS.

- F. Assemble required LEED Submittal information into one (1) package for each Specification Section or sub-contractor. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submittal products or assemblies.
- G. Provide manufacturer's product documentation for each product having an Environmental Product Declaration (EPD).
- H. Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- I. Provide manufacturer's or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017.

#### 1.5 SUBMITTALS

- A. Product Data: Submit data for proprietary materials and items, including the following:
  - 1. Reinforcement
  - 2. Supports for reinforcement
  - 3. Forming accessories
  - 4. Admixtures
  - 5. Patching compounds
  - 6. Waterstops
  - 7. Joint systems
  - 8. Curing compounds
  - 9. Curing methods and other product data used.
  - 10. Dry-shake finish materials
  - 11. Others items as requested by Architect.
- B. Shop Drawings; Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures. Include size, spacing, and type of reinforcement supports/bolsters. The shop drawings shall be prepared only by competent detailers, checked by the contractor prior to submission.
  - 1. The shop drawings shall show construction, contraction and isolation joint locations and the added reinforcement required at same.
  - 2. Obtain and coordinate information for sleeves and openings in concrete, which are required for the work of other trades. Make coordinated drawings showing size and location of openings and sleeves and incorporate this information on the reinforcing drawings.
  - 3. Only those splices indicated on the approved shop drawings will be permitted.
  - 4. Provide elevations of all foundation walls and other structural elements to a minimum 1/4" scale.

- C. Shop Drawings Formwork: Submit shop drawings for fabrication and erection of specific finished concrete surfaces. Show form construction including jointing, special form joint or reveals, location and pattern of form tie placement, and other items which affect exposed concrete visually. Architect's review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is Contractor's responsibility, prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect.
- E. Contraction Joint Layout: Indicate proposed contraction joints required per applicable codes and drawings.
1. Location of contraction joints is subject to approval of the Architect.
- F. The use of the Architect's or Engineer of Record's electronic drawing files as a base for the reinforcement, formwork, and joint layout shop drawings will be permitted at the request of the detailer/designer upon completion and return of the waiver form. The use of the Architect's or Engineer of Record's electronic drawing files as a base for shop drawing details will not be permitted. The detailer/designer will be responsible for compatibility of the files with his hardware or software. The electronic files are not to be considered the contract documents, the design team makes no representation regarding the accuracy or completeness of the electronic files given to detailer/designer and their use will be at the detailer/designer's sole risk and without liability to the design team. The detailer/designer shall remove the project title box and all references to the structural drawings including drawing numbers and structural drawing sections and details. The detailer/designer shall also remove all reference to work not included in the concrete contract.
- G. Scaling of the Architect's or Engineer of Record's drawings is not permitted. This applies to hard paper, electronic, and all other versions.
- H. Samples: Submit samples of materials as requested by Architect, including names, sources and descriptions.
- I. Concrete finisher credentials: Submit ACI certification credentials (certificate or wallet card) of concrete finishers on project.
- J. Laboratory Test Reports: Submit laboratory test reports for concrete materials, mix design test and microwave test.
- K. Material Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Architect. Manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements shall sign material

certificates. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

- L. Cold Weather and Hot Weather Concreting Procedures: Submit written descriptions of contractor's proposed cold weather and hot weather concreting procedures, when applicable.
- M. Certification that pozzolanic materials conforms to ASTM C 618-01 (noting class C or class F), ASTM C 989 or ASTM C1240.
- N. Certified recycled steel content. Provide cut sheets clearly indicating whether the rebar used meets the minimums for post-consumer OR post-industrial recycled contents. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and if the recycled content is post-consumer or post-industrial.
- O. Formwork: Specify whether reusable, permanent, salvaged or new wood forms are to be used.
- P. Recycled Aggregate: Provide laboratory reports indicating that aggregate conforms to ASTM C33 for structural concrete or ASTM D1241-00 for sub-base material. Provide cut sheets clearly indicating the source, total weight and volume of the recycled aggregate. If aggregate provided is a mix of virgin and recycled aggregates obtain a written affidavit from the manufacturer stating the recycled content percentage
- Q. VOC content for curing compounds, sealants and release agents: Provide a cut sheet and a Material Safety Data Sheet (MSDS) for each curing compound, sealant, hardener and release agent used highlighting VOC contents. VOC content must be less than or equal to limits stated under "PRODUCTS".

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician. A minimum of one finisher or finishing supervisor shall be currently certified as an ACI Flatwork Concrete Finisher when installing all exterior exposed concrete flatwork and interior exposed polished concrete flatwork.
- B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- D. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
  - 1. New York State Building Code, 2020

2. ACI 117 "Standard Specifications for Tolerances for Concrete Construction and Materials and Commentary."
  3. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight and mass concrete."
  4. ACI 211.2, "Standard Practice for Selecting Proportions for Structural Lightweight Concrete."
  5. ACI 214R, "Evaluation of Strength Test Results of Concrete."
  6. ACI 232.2R, "Use of Fly Ash in Concrete."
  7. ACI 233R, "Guide to Use of Slag Cement in Concrete and Mortar."
  8. ACI 234, "Guide for the Use of Silica Fume in Concrete."
  9. ACI 301 "Specifications for Structural Concrete."
  10. ACI 302.1R "Guide for Concrete Floor and Slab Construction."
  11. ACI 304R, "Guide for Measuring, Mixing, Transporting and Placing Concrete."
  12. ACI 305R "Hot Weather Concreting."
  13. ACI 306R-10 "Guide to Cold Weather Concreting."
  14. ACI 308.1 "Standard Specification for Curing Concrete."
  15. ACI 309R, "Guide for Consolidation of Concrete."
  16. ACI 311.4R, "Guide for Concrete Inspections."
  17. ACI 315, "Details and Detailing of Concrete Reinforcement."
  18. ACI 318 "Building Code Requirements for Structural Concrete and Commentary."
  19. ACI 347 "Guide to Formwork of Concrete."
  20. Concrete Reinforcing Steel Institute, (CRSI) "Manual of Standard Practice."
  21. CRSI-WCRSI, "Placing Reinforcing Bars."
  22. AWS D1.4, "Structural Welding Code Reinforcing Steel."
  23. The ACI Field Reference Manual, SP-15 shall be kept at the job site, and the practices set forth therein shall be strictly adhered to.
  24. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.
  25. AASHTO T 318, "Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying."
- E. Concrete Testing Service: Owner will engage a testing laboratory acceptable to Architect and Engineer of Record to perform material evaluation tests and to design concrete mixes.
- F. Materials and installed work may require testing and retesting at anytime during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.
- G. Mockups: Mockups for site stairs will be required. Details to be discussed at pre-construction meeting.
- H. Preconstruction Meeting:
1. At least 35 days prior to the start of the concrete construction schedule, the Contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction. The Contractor shall send a pre-concrete conference agenda to all attendees 20 days prior to the scheduled date of the conference.

2. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:
  - a. Contractor's superintendent
  - b. Laboratory responsible for the concrete design mix
  - c. Laboratory responsible for field quality control
  - d. Concrete subcontractor
  - e. Ready-mix concrete producer
  - f. Admixture manufacturer(s)
  - g. Concrete pumping equipment manufacturer.
3. Topics for discussion at the meeting shall include, but not be limited to, the following: Mitigating weather conditions including high evaporability, moisture sensitivity of floor coverings, proper curing procedures, minimizing shrinkage cracking, mix design, cement paste content, aggregate gradation, placement and finishing techniques, protecting base course prior to slab on grade placement, flatness/levelness criteria, construction joints, vapor barriers, list of critical items for inspection, water control, communication, and key concrete tolerances.
4. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed by the contractor to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes: Owner or owner's representative, Architect, and Engineer of Record.
5. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design and placing can produce the concrete quality required by these specifications.
6. A minimum of a 4 cubic yard trial mixture containing all required admixtures shall be placed at the job site using the accepted methods of placing, finishing and curing. All applicable tests including slump, strength, water content, air content, permeability, and air content will be performed. This shall occur at least four weeks before actual concreting operations with the proposed mix design begins. The admixture manufacturer(s) and inspectors shall be present. The same testing should be done in the laboratory at the same time for comparison. A test sample should be done for each condition that is to be placed.
7. The Engineer of Record will be present at the conference. The Contractor shall notify the Engineer of Record at least 10 days prior to the scheduled date of the conference.

#### 1.7 PROJECT CONDITIONS

- A. The Contractor, before commencing work, shall examine all adjoining work on which this work is in any way dependent for proper installation and workmanship according to the intent of this specification, and shall report to the Architect or Engineer of Record any condition which prevents this contractor from performing first class work.
- B. Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing; maintain cover for time period as necessary.
- C. Protect adjacent finish materials against spatter during concrete placement.

- D. Provide all barricades and safeguards at all pits, holes, shaft and stairway openings, etc., to prevent injury to workmen and others within and about the premises. Also provide all safeguards as required by the Building Code, OSHA, or any other departments having jurisdiction. Take full responsibility for all safety precautions and methods.
- E. Procedure of Work: The contractor shall keep themselves constantly informed as to the progress of the work in the field, materials and workers ready to start work immediately when conditions of preceding work are available or ready, wholly or in part, so as not to delay the progress of building work or to interfere with the progress of work of other contractors, and in any event the contractor shall, within 24 hours after notice from the Owner, proceed with such work as directed to maintain the uninterrupted progress of the work.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

### PART 2 - PRODUCTS

#### 2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct of plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient strength and thickness to withstand pressure of newly placed concrete without bow or deflection.
  - 1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better mill oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Preference shall go to salvaged or re-used Dimensional Lumber. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Coatings: Provide VOC compliant commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces. Use biodegradable form release agent listed below or equivalent made from soy or rapeseed oil.
  - 1. "Clean Strip J1EF" Dayton Superior
  - 2. "Soy Form Away" Cure & Seal by Natural Soy Products
  - 3. "Bio-Form" Leahy-Wolf Company

- 4. "Duogard II" W. R. Meadows, Inc.
- 5. "Atlas Bio-Guard" Atlas Construction Supply, Inc.

- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Form Ties: Form ties and spreaders: Factory fabricated and either removable or snap-off, prefabricated assemblies by Richmond, Superior, Dayton or approved equal. Wire ties and embedded PVC pipe shall not be used. Ties for foundation work shall be of snap design with removal cones and water seal washer.

## 2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615 M, Grade 60.
- B. Weldable Reinforcing Bars: ASTM A 706/A 706M, Grade 60.
  - 1. Provide products with Third Party Environmental Product Declaration (EPD) whenever available.
- C. Galvanized Reinforcing Bars: ASTM A 767, Class II (2.0 oz. zinc psf) Class I (3.0 oz. zinc psf) hot-dip galvanized, after fabrication and bending.
- D. Epoxy-Coated Reinforcing Bars: ASTM A 775 (as noted on plan and/or in section).
- E. Steel Wire and Welded Wire Reinforcement: ASTM A 1064. Galvanized at exterior locations, conditions permanently exposed to weather and/or water, and where noted on drawings (plan and/or sections).
  - 1. Provide products with Third Party Environmental Product Declaration (EPD) whenever available.
- F. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 , plain-steel bars, cut true to length with ends square and free of burrs.
- G. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 , plain-steel bars, ASTM A 775/A 775M epoxy coated.
- H. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- I. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- J. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire reinforcement in place. Use wire bar type supports complying with CRSI specifications.



1. For epoxy coated reinforcement provide plastic protected chairs and plastic ties. All imperfections in the epoxy coating are to be repaired prior to placement of concrete.
  - a. Use recycled plastic rebar supports (give preference to local supplier if available). Subject to compliance with requirements, provide one of the following:
    - 1) International Plastics Group
    - 2) Eclipse Plastic
2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2), at a spacing not to exceed 4'-0" on center in either direction.

### 2.3 CONCRETE MATERIALS

- A. Portland cement: ASTM C 150, Types I, II, or I/II. Total percentage of Portland Cement is NOT to exceed 75% of the cementitious content of each mix. Use one brand of cement throughout project, unless otherwise acceptable to Architect. Provide either fly ash or GGBF in mix per sections below.
  - a. Fly Ash: Cast-in-place concrete shall incorporate fly ash as a replacement for at least 25% (by weight) of the Portland cement. Exterior exposed concrete shall have 25% fly ash by mass (and no greater). All design mixes must be reviewed and approved by the Engineer of Record. Fly Ash shall not be used in conjunction with Ground Granulated Blast Furnace Slag.
  - b. Ground Granulated Blast Furnace Slag (GGBF): Cast-in-place concrete shall incorporate GGBF as a replacement for at least 40% (by weight) of the Portland cement. Exterior exposed concrete shall have a maximum of 50% slag (by mass). All design mixes must be reviewed and approved by the Engineer of Record. GGBF shall not be used in conjunction with Fly Ash.
  - c. Pozzolans and Slags: These must be completely accounted for in the design mix. Mix design must meet minimum design requirements set in the contract documents. Additional admixtures may be required to meet early strength requirements and alternative cementitious material goals. If a "blended cement" is used which already contains a certain percentage of Pozzolans or Slags this content may offset or entirely satisfy the minimum percentage required.
    - 1) Coal Fly Ash: ASTM C 618 (Class C or Class F): ASTM C 618 (Note: Class F fly Ash will require higher amounts or air entraining admixtures than class C).
    - 2) Blast Furnace Slag: ASTM C989
    - 3) Silica Fume: ASTM C 1240 (Exterior exposed concrete shall have a maximum of 10% by mass).
- B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

1. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.
2. Normal weight Fine Aggregate: washed, inert, natural or manufactured or combination thereof, sand conforming ASTM C33 gradation.
3. Normal weight Coarse Aggregate: well graded crushed stone or washed gravel conforming to ASTM C33, sizes 57 for foundations and 67 for slabs and structure.
  - a. Recycled crushed concrete aggregate in concrete mixes is only to be used with approval of Engineer of Record. Recycled aggregate shall be used only as a substitute for coarse aggregate and must also be washed and well-graded, conforming to ASTM C33.
  - b. For sub-base, slabs on grade and non-structural applications and Recycled Aggregate Materials are NOT required to meet the ASTM C 33 standard. In addition to concrete rubble, glass, porcelain, and tire chips can be used as filler material. Any inert material conforming to ASTM D1241 is acceptable for the applications described in this paragraph.
4. For aggregate used in concrete in exposure category C1, C2, F1, F2, and F3, the following additional requirements apply:
  - a. Aggregates shall be on the New York State DOT list of approved aggregate sources and shall not be designated as having ASR potential.
  - b. The minimum bulk SSD specific gravity of the coarse aggregate on the New York State DOT posted test results shall be 2.67.
  - c. The maximum absorption of the coarse aggregate on the New York State DOT posted test results shall be 1.2%.
- C. Lightweight Aggregates: Well-graded crushed expanded shale produced by rotary kiln method. Solite or equal, conforming to ASTM C330.
- D. Water: Free from oils, acids, alkali, organic matter and other deleterious material to conform to ASTM C94. ASTM C94 for gray water use in the production of ready mixed concrete per approval by the Engineer of Record.
- E. Air Entraining Admixture: ASTM C 260.
  1. Liquid air entrainment: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. "Air Mix"	Euclid Chemical
b. "AEA-92"	Euclid Chemical
c. "Darex AEA"	W. R. Grace
d. "MasterAir VR 10"	Master Builders
- F. Water-Reducing Admixture: ASTM C 494.
  1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. "MasterPolyheed 997"	Master Builders
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- b. "Euclid MR" Euclid Chemical  
c. "WRDA 64" W. R. Grace.
- G. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G and containing not more than 0.05 percent chloride ions.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
- a. "Eucon 37, 1037 or Plastol 5000" Euclid Chemical Co.  
b. "Rheobuild 1000" Master Builders  
c. "MasterGlenium 7500" Master Builders  
d. "Daracem-100" W. R. Grace
- H. Water Reducing, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C 494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Accelerating admixtures are not to be used as antifreeze agents. Accelerating admixtures are permitted only upon review by Engineer of Record.
1. Products: Subject to compliance with requirements, provide the following or equal approved by Engineer of Record:
- a. "Accelguard 80" Euclid Chemical Co.  
b. "Daraset" W. R. Grace  
c. "Pozzutec 20" Master Builders.
- I. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and contain not more than 0.05 percent chloride ions.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
- a. "Eucon Retarder 75" Euclid Chemical Co.  
b. "Pozzolith 100XR" Master Builders.  
c. "Plastiment" Sika Chemical Co.  
d. "Daratard" W.R. Grace.
- J. Microsilica Admixture shall be dry densified or slurry formed. Microsilica shall come from the same source throughout the project. If a single source cannot be maintained, laboratory testing of each new source shall be required before acceptance by the Engineer of Record at no cost to the owner.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
- a. "Emsac F 100" Elkem Chemical, Inc.  
b. "Eucon MSA" Euclid Chemical Co.  
c. "Force 10,000" W. R. Grace

- K. Prohibited Admixtures: Calcium chloride, thycyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.
- L. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of admixtures will be required from the admixture manufacturer prior to mix design review by the Engineer of Record.
- M. Natural Fiber Reinforced Concrete: Natural fiber reinforced concrete is permitted only upon review by Engineer of Record. Refer to ACI 544.1R, chapter 5
- N. Corrosion Inhibitor: 30% calcium nitrite (where called for in the specifications or on the drawings). Subject to compliance with requirements, provide the following at 3 gal/cy:
1. "Eucon CIA" Euclid Chemical
  2. "DCI" W. R. Grace
  3. "Rheocrete CNI" Master Builders.
- O. Contractor will be required to provide information demonstrating successful use in prior placement involving all admixtures.

#### 2.4 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
    - a. "MiraSTOP" Carlisle Coatings & Waterproofing, Inc.
    - b. "Waterstop-RX" CETCO
    - c. "Conseal CS-231" Concrete Sealants Inc.
    - d. "Swellstop" Greenstreak
    - e. "Hydro-Flex" Henry Company, Sealants Division
    - f. "Earth Shield Type 20" JP Specialties, Inc.

#### 2.5 GROUT

- A. Non-Shrink, Non-Metallic Grout: The non-shrink grout shall be a factory pre-mixed grout and shall conform to ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 4' x 4' base plate.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
    - a. "Euco-NS" Euclid Chemical Co.
    - b. "Five Star Grout" U.S. Grout Corp.

c. "Masterflow 713 Plus" BASF

B. High Flow Grout: Where high fluidity and/or increased placing time is required, use high flow grout. The factory pre-mixed grout shall conform to ASTM C1107, "Standard Specification for Packages Dry, Hydraulic-Cement Grout (Non-shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 18" x 36" base plate.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

- |    |                             |                     |
|----|-----------------------------|---------------------|
| a. | "Euco Hi-Flow Grout"        | Euclid Chemical Co. |
| b. | "Masterflow 928"            | BASF                |
| c. | "Five Star Fluid Grout 100" | Five Star           |

## 2.6 RELATED MATERIALS

A. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 1241, Size 57, with 100 percent passing a 1-1/2 inch sieve and 0 to 5 percent passing a No. 8 sieve.

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 1241, Size 10, with 100 percent passing a 3/8 inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

C. Non-slip Aggregate Finish: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40% aluminum oxide and not less than 25% ferric oxide. Use material that is factory-graded, packaged, rustproof and non-glazing, and is unaffected by freezing, moisture, and cleaning materials.

D. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

E. Moisture-Retaining Cover: One of the following, complying with ASTM C 171. Cover shall contain either an un-pigmented non-woven polypropylene fabric or 10 oz. burlap.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal by Engineer of Record:

- |    |                   |                 |
|----|-------------------|-----------------|
| a. | "Transguard 4000" | Reef Industries |
| b. | "UltraCure DOT"   | Sika            |
| c. | Burlene           |                 |

F. Curing Compounds: The compound shall conform to ASTM C 309. Limit VOC content to 130 g/L. Use water-based curing compound. For surfaces receiving both a curing

compound and additional flooring, verify that the curing compound and additional flooring are compatible.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
  - a. "SealTight 1100" W.R. Meadows
  - b. "Kurez W VOX" Euclid Chemical Co.
  - c. "Everclear VOX" Euclid Chemical Co.
  - d. "VOCOMP-25" W.R. Meadows
  
- G. Curing & Sealing Compounds: Only specify for slabs that will remain exposed, i.e. will not receive additional flooring. The compound shall conform to ASTM C1315. Limit VOC content to 130 g/L. Use water-based curing compound.
  1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
    - a. "Everclear VOX" Euclid Chemical Co.
    - b. "VOCOMP-25" W.R. Meadows
  
- H. Sealers/Hardeners: For use on concrete surfaces that will remain exposed. Slabs that will receive additional flooring do not require sealing or hardening. Sealers and hardeners must not yellow under ultra violet light after 500 hours of test in accordance with and have a maximum moisture loss of 0.039 grams per sq. cm. when applied at a coverage rate of 250 sq. ft. per gallon. Limit VOC content to 130 g/L. Use water- or vegetable-based product.
  1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
    - a. "Kure-N-Harden" BASF
  
- I. For concrete floors subjected to heavy vehicular traffic use a Liquid Sealer/Densifier: The product must be a high performance, deeply penetrating concrete densifier conforming to ASTM C836; odorless, colorless, VOC - compliant, non-yellowing silicate based solution designed to harden, dustproof and protect and to resist black rubber tire marks on concrete surfaces. The compound must contain a minimum of 20% solids content of which 50% is silicate
  
- J. Evaporation Retardant:
  1. Products Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
    - a. "Eucobar" Euclid Chemical Co.
    - b. "MasterKure ER 50" BASF
  
- K. Certify that all curing compounds, sealers and hardeners are compatible with all adhesive products intended for attaching co-lateral floor material. In conformance with ASTM F 710, coordination with flooring manufacturer is required to insure concrete coatings will

not obstruct the bond between the concrete and the adhesive. Insure coatings and adhesives are "benignly compatible" -- in other words, do not combine substances whose constituents are reactive. Reactivity releases VOCs and /or other toxic fumes.

- L. Crack Sealer: Elastomeric liquid crack sealer resistant to water, gasoline, oil and salts.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
    - a. "Eucolastic 1NS" Euclid Chemical Co.  
Maximum allowable depth of this product is 1/2".
- M. Underlayment Compound: Free flowing, self-leveling, pumpable cementitious base compound.
1. Products: Subject to compliance with requirements, provide the following or equal approved by Engineer of Record:
    - a. "Flo-Top 90 or Super Flo-Top" Euclid Chemical Co.
    - b. "Ardex" Ardex Co.
    - c. "Underlayment 110" Master Builders
- N. Bonding Admixture: The compound shall be a latex, non-rewettable type.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
    - a. "Flex-Con" Euclid Chemical Co.
    - b. "SBR Latex" Euclid Chemical Co.
- O. High Strength Polymer Repair Mortar: For form and pouring or large horizontal repairs, provide the flowable on-part, high strength repair mortar.
1. Products: subject to compliance with requirements, provide the following or equal approved by Engineer of Record:
    - a. "Euconcrete" The Euclid Chemical Co.
    - b. "Euco Speed MP" (Cold Weather) The Euclid Chemical Co.
    - c. "Emaco R" Master Builders.
- P. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- a. "Daraweld C" W.R. Grace
- Q. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Type IV for bonding hardened concrete to hardened concrete, and Type V for bonding freshly mixed concrete to hardened concrete.

- R. Reglets: Fabricate reglets of not less than 0.022 inch thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- S. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- T. Vapor Barrier: Provide vapor barrier which conforms to ASTM E 1745, Class A or B. The membrane shall have a water-vapor permeance rate no greater than 0.012 perms when tested in accordance with ASTM E 154, Section 7. The vapor barrier shall be placed over prepared base material where indicated below slabs on grade. Vapor barrier shall be no less than 10 mil thick in accordance with ACI 302.1R. Preferred vapor barriers will be manufactured from post-consumer recycled polymers.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
- |    |  |                  |
|----|--|------------------|
| a. | "Stego Wrap (15 mil) Vapor Barrier"<br>LLC | Stego Industries |
| b. | "Griffolyn Vaporguard"                     | Reef Industries  |
| c. | "Premoulded Membrane with Plastmatic Core" | W.R. Meadows.    |
- U. Expansion Joint Filler: ASTM D 1751.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
- |    |  |                  |
|----|--|------------------|
| a. | "Homex 300"                            | Homasote Company |
| b. | "Standard Cork Expansion Joint Filler" | APS Cork         |
| c. | "Fibre Expansion Joint"                | W.R. Meadows     |
- V. Water: Potable.

## 2.7 PROPORTIONING AND DESIGN OF MIXES

### A. Preparation of Design Mixes

1. All mix designs shall be proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318 and prepared by a licensed testing laboratory approved by the owner, but paid for by the contractor. Submit mix designs on each class of concrete for review.
2. If previously used mixes are submitted, all materials shall be from the same sources and with the same brand names as the previously utilized mix.
3. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve an average compressive strength 1200 psi higher than the specified strength. This over-design shall be increased to 1.10f<sub>c</sub>+700 psi when concrete strengths greater than 5000 psi are used.
4. The proposed mix designs shall be accompanied by complete standard deviation analysis or trial mixture test data.



- B. Submit each proposed mix to the Architect and Structural Engineer for review at least 5 days prior to the pre-concrete conference. Do not begin concrete production until Architect and Engineer of Record has reviewed and approved mixes.
1. Submit Test reports for any pozzolans or slags indicating compliance with ASTM C 618 or ASTM C 989, respectively.
  2. Provide cut sheets clearly indicating the percentages of pozzolans or slags used in the mix design as replacement for Portland cement. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the percentage.
  3. Test reports for recycled aggregate indicating compliance with ASTM C 33. Provide cut sheets clearly indicating the percentage of aggregates used that are recycled. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and source or sources of the material.
  4. Provide cut sheets clearly indicating the percentage of sub-base and filler aggregate materials that are recycled. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and source or sources of the material.
  5. Submit verification that each mix does not exceed the maximum water-soluble chloride ion limits per ACI 318 Table 19.3.2.1 (0.15% chloride ions by weight of cement). Submit verification of chloride ion permeability per section H below.
- C. Design mixes to provide concrete with strength as indicated on drawings and schedules.
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect and Engineer of Record. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect and Engineer of Record before using in work.
- E. Admixtures:
1. Use water-reducing admixture or high range water-reducing admixture (superplasticizer) in all concrete as required for placement and workability.
  2. Use non-corrosive, non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50°F (10°C).
  3. Use high-range water-reducing admixture in pumped concrete, architectural concrete, parking structure slabs, fiber concrete, concrete required to be watertight, concrete with ultimate strength of 5,000 psi or more, and concrete with water/cement ratios below 0.50.
  4. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Exposure category for exterior concrete and interior concrete in unconditioned space is F3 (Freezing and thawing), S1 (Sulfate), W1 (In contact with water), and C2 (Corrosion protection of reinforcement). Exposure category for interior concrete in conditioned space is F0, S0, W0, and C0. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus-or-minus 1-1/2 percent within following limits:

- a. Concrete structures and slabs exposed to freezing and thawing or deicer chemicals.
    - 1) 1-1/2" maximum aggregate: 5.5 percent (exposure class F3, severe exposure)
    - 2) 1" maximum aggregate: 6 percent (exposure class F3, severe exposure)
    - 3) 3/4" maximum aggregate: 6 percent (exposure class F3, severe exposure)
    - 4) 1/2" maximum aggregate: 7 percent (exposure class F3, severe exposure)
    - 5) 3/8" maximum aggregate: 7.5 percent (exposure class F3, severe exposure)
  - b. Other Concrete: (not exposed to freezing, thawing, or hydraulic pressure): 2 percent to 4 percent air.
  - c. Interior concrete to receive hard troweling shall not be air entrained unless specifically approved by the Engineer.
5. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
- F. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:
1. Concrete for precast slabs, precast beams, structural topping slab, caisson caps, caissons, poured in place slabs and grade beams, columns and walls, over water, on ground or exposed to weather: W/C 0.40.
  2. Concrete on metal deck:
    - a. With specified minimum compressive strength not greater than 5,000 psi: 0.40.
    - b. With specified minimum compressive strength not greater than 7,000 psi: 0.35.
  3. "Quick Dry" Concrete: 0.40.
  4. Subjected to freezing and thawing; W/C 0.40.
  5. Subjected to deicers/watertight: W/C 0.40.
  6. Reinforced concrete subjected to brackish water, salt spray or deicers; W/C 0.40.
- G. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
1. Ramp slabs and sloping surfaces: Not more than 3".
  2. Reinforced foundation systems, including mud slabs below hydrostatic slabs: Not less than 1" and not more than 3".
  3. Concrete containing HRWR admixture (superplasticizer): Not more than 9" unless otherwise approved by the architect. The concrete shall arrive at the job site at a slump of 2" to 3" (3" to 4" for concrete receiving a "shake-on" hardener or lightweight concrete), be verified, then the high-range water-reducing admixture added to increase the slump to the approved level.
  4. Other Concrete: Not less than 1" or more than 4".

- H. Chloride Ion Level: Chloride ion content of aggregate shall be tested by the laboratory making the trial mixes. The total chloride ion content of the mix including all constituents shall not exceed the limitations set forth in Table 19.3.2.1 of ACI 318 for concrete subjected to deicers or exposed to chloride in service (0.15% chloride ions by weight of cement). The concrete producer shall provide verification as a submittal for review.
  - 1. In addition, the mix designs for all concrete exposed to de-icing salts (all exterior concrete) shall limit chloride ion permeability to 1000 coulombs when tested at 56 days according to either ASTM C 1202, AASHTO T259, or AASHTO T277.

## 2.8 CONCRETE MIXING

- A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
- B. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.
- C. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required. When air temperature is between 85°F (30°C) and 90°F (32°C), reduce maximum mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce maximum mixing and delivery time to 60 minutes.
- D. No water shall be added after mixing without approval of structural engineer, including to concrete containing HRWR (Superplasticizer). If loss of slump occurs, the concrete treated with HRWR may be redosed as long as a "flash set" has not occurred. Redosage procedures must be discussed and approved by the Engineer of Record and the manufacturer.
  - 1. The contractor is required to clearly note on the delivery ticket the quantity of water withheld at the batching plant that can be added onsite.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

### 3.2 INSPECTION

- A. Examine all work prepared by others to receive work of this section and report any defects affecting installation to the Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

3.3 CONCRETE

- A. Concrete shall develop the minimum compressive strengths shown on drawings at 28 days when sampled and tested in accordance with ASTM C 31 and C 39 with the maximum slump in accordance with the approved mix design.
- B. Concrete shall be in accordance with the requirements and specifications of "Building Code Requirements for Structural Concrete" as modified by the building code noted above.
- C. Fly Ash Concrete & Slag Concrete: Concrete mixes containing high volumes of fly ash or Slag have slower set times and may take up to 56 days to reach full strength. The Engineer of Record, agency responsible for concrete mix design, the architect and the concrete subcontractor must coordinate to ensure that the form stripping schedule is consistent with the ability of the structure to support itself and all imposed construction loads.

3.4 FORMS

- A. Design formwork to maximize its reusability, reduce resources devoted to formwork construction and minimize waste generated. Where appropriate choose alternative formwork systems (refer to sections listed above).
- B. Design, erect, support, brace and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shapes, alignment, elevation and position. Maintain formwork construction tolerances complying with ACI 347. Provide Class A tolerances for concrete exposed to view. Provide Class C tolerances for other concrete surfaces.
- C. Design formwork to be readily removable without impact, shocks or damage to cast-in-place concrete surfaces and adjacent materials.
- D. Construct forms to size shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back- up at joints to prevent leakage of cement paste.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, recesses, and the like, to prevent swelling and for easy removal.
- F. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

- G. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- H. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.
- I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

### 3.5 VAPOR BARRIER INSTALLATION

- A. Examine the condition of porous fill and remedy any unsatisfactory portions prior to installing vapor barriers.
- B. Sub-base material to be per above sections.
- C. Following leveling and tamping of sub-base for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of pour.
- D. Lap joints 6" and seal with appropriate tape.
- E. After placement of moisture barrier, cover with granular material and compact to depth as shown on drawings.
- F. Avoid cutting or puncturing vapor barrier during reinforcement placement and concreting operations.

### 3.6 PLACING REINFORCEMENT

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials, which reduce or destroy bond with concrete.
- C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Place reinforcement to obtain at least minimum coverage's for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

- E. Install welded wire reinforcement in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
- F. Epoxy-coated reinforcing bars supported from formwork shall rest on coated wire bar supports. Reinforcing bars used as support bars shall be epoxy-coated. In walls having epoxy-coated reinforcing bars, spreader bars where specified by the Architect or Engineer of Record, shall be epoxy-coated. Proprietary combination bar clips and spreaders used in walls with epoxy-coated reinforcing bars shall be made of corrosion-resistant material.
- G. Epoxy-coated reinforcing bars shall be fastened with nylon- , epoxy- , or plastic-coated tie wire, or other acceptable materials.
- H. Repair of damaged epoxy-coating: When required, damaged epoxy-coating shall be repaired with patching material conforming to ASTM A775. Repair shall be done in accordance with the patching material manufacturer's recommendations.
- I. Unless permitted by the Engineer of Record, epoxy-coated reinforcing bars shall not be cut in the field. When epoxy-coated reinforcing bars are cut in the field, the ends of the bars shall be coated with the same material used for repair of coating damage.

### 3.7 JOINTS

- A. Construction Joints: Locate and install construction joints as indicated, or if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.
- B. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.
- D. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions, using manufacturer's specified welding irons.
- E. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals and elsewhere as indicated.
  - 1. Joint filler and sealant materials are specified in the section for "Related Materials"
- F. Contraction (Control) Joints in Slabs-on-Ground: Maximum joint spacing shall be 36 times the slab thickness unless otherwise noted on the drawings. The dry cut saw shall be used immediately after final finishing and to a depth of 1-1/4". A conventional saw shall be used as soon as possible without dislodging aggregate and to a depth of 1/4 slab thickness.

1. Joint sealant material is specified in the section for "Related Materials".

### 3.8 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.
- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.
- C. Embedded Plates at Foundation Walls: Install plate at top of forms so that exterior face of steel plate is level and plumb. Use construction documents for locations, sizes and elevations.

### 3.9 PREPARATION OF FORM SURFACES

- A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- B. If form-release compound is required, coat contact surfaces of forms with a form-coating compound *before* reinforcement is placed.
- C. Thin form-coating compounds only with thinning agent of type, and amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

### 3.10 CONCRETE PLACEMENT

- A. Ready-mix concrete shall comply with the requirements of ASTM C 94 and ACI 304. All plant and transporting equipment shall comply with the concrete plant standards and truck mixer and agitator standards of the National Ready Mix Concrete Association.
- B. Cold weather mixing procedures shall be submitted to the architect for approval.
- C. Notify Architect and Owner's Inspector at least 36 hours (1 1/2 regular working days) before each pour so that forms and reinforcing may be examined. Do not place concrete until inspection has been made or waived.

- D. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
1. Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.
- E. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.
1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- F. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints. Use internal vibrators penetrating both the top and preceding layers.
- G. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
- H. Use and type of vibrators shall conform to ACI 309 "Recommended Practice for Consolidation of Concrete." Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- I. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
- J. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- K. Slabs: Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedge, bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. See also "MONOLITHIC SLAB FINISHES" below.
- L. Maintain reinforcing in proper position during concrete placement operations.



- M. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
1. When air temperature has fallen to or is expected to fall below 40°F (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (27°C) at point of placement.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Use only a non-corrosive, non-chloride accelerator. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are NOT permitted.
  4. Care must be taken to store water-based curing and sealing compounds where they will not freeze. In most cases, they cannot be reconstituted after thawing.
- N. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F (32°C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
  2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
  3. Fog spray forms, reinforcing steel and subgrade just before concrete is placed.

### 3.11 FINISH OF FORMED SURFACES

- A. Concrete mixes containing pozzolans or slags do not set at the same rate or with the same bleed water characteristic as plain Portland cement. Therefore attention must be directed to the proper procedures. Refer to ACI 232.2R and ACI 301.
- B. Rough Form Finish: For formed concrete surface not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.
- C. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed. Follow all requirements in ACI 301, Chapter 10 for smooth form finish. Surface preparation for surfaces receiving waterproofing must be approved by the waterproofing manufacturer prior to construction.

3.12 FLOOR FLATNESS/LEVELNESS TOLERANCES

- A. FF defines the maximum floor curvature allowed over 24 in. Computed on the basis of successive 12 in. (300 mm) elevation differentials, FF is commonly referred to as the "Flatness F-Number".
- B. FL defines the relative conformity of the floor surface to a horizontal plane as measured over a 10 ft. (3.05 m) distance commonly referred to as the "Levelness F-Number".
- C. All floors shall be measured within 72 hours of being poured and in accordance with ASTM E 1155 "Standard Test Method for Determining Floor Flatness and Levelness Using the "F Number" System (Inch-Pound Units).
- D. All slabs shall achieve the specified overall tolerance. The minimum local tolerance (1/2 bay or as designated by the architect) shall be 2/3 of the specified tolerances.
- E. All elevated slabs shall achieve the specified FL tolerance before the removal of the forms.
- F. All slabs on metal deck shall achieve the specified FF.

3.13 MONOLITHIC SLAB FINISHES

- A. Float Finish: Apply float finish to slabs at crawl spaces, unless otherwise noted. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture. Surface shall achieve an FF 20 - FL 17 tolerance.
- B. Trowel Finish: NOTE: Air-entrained concrete shall not be trowel finished. Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system, unless otherwise noted. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance and with a surface leveled to an FF 25/ FL 20 tolerance (FL17 for elevated slabs). Grind smooth surface defects, which would telegraph through applied floor covering system.
- C. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, and slab surfaces which are to be covered with membrane or elastic waterproofing, or sand-bed terrazzo, and as otherwise indicated, apply single trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming. Surface preparation for surfaces receiving waterproofing must be approved by the waterproofing manufacturer prior to construction

- D. Sealers, Hardeners and Liquid Densifiers: Apply a coat of the specified compound to all EXPOSED interior concrete floors where indicated on the drawings. This surface must be continuously moist cured by a method satisfactory to the Architect. Apply and mechanically scrub compound into the floor in strict accordance with the manufacturer's printed instructions.

### 3.14 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
  2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
  3. In order to avoid plastic or drying shrinkage cracks during warm, dry or windy weather, ACI 302 and ACI 308 shall be followed using wind breaks and sun shades when recommended. Evaporation retardant shall be as specified in Section 2.04.
  4. Care must be taken to store water based curing and sealing compounds where they will not freeze. In most cases, they cannot be reconstituted after thawing.
- B. Curing Methods: Perform curing of concrete by moisture curing, moisture-retaining cover curing, curing and sealing compound, and by combinations thereof, as herein specified. NOTE: All exterior concrete must utilize a minimum seven day wet cure.
1. Provide moisture curing by following methods.
    - a. Keep concrete surface continuously wet by covering with water.
    - b. Continuous water-fog spray.
    - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
  2. Provide moisture-retaining cover curing as follows:
    - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  3. Provide curing and sealing compound to exposed interior slabs not receiving additional flooring. A clear curing and sealing compound shall be used on exterior slabs, sidewalks and curbs not receiving a penetrating sealer.
  4. Use the specified curing compound on surfaces to be covered with finish or coating material applied directly to concrete, such as liquid densifier/sealer, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials. Apply compound in accordance with manufacturer's direction.

- C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of the specified curing compound or a continuous moist curing method approved by the architect.
- E. Certify that all curing compounds, sealers and hardeners are compatible with all adhesive products intended for attaching co-lateral floor material. In conformance with ASTM F710, coordination with flooring manufacturer is required to insure concrete coatings will not obstruct the bond between the concrete and the adhesive. In addition, insure coatings and adhesives are "benignly compatible" -- in other words, do not combine substances whose constituents are reactive.
- F. Sealer and Dustproofers: Apply a second coat of the specified curing and sealing compound to exposed interior slabs not subjected to vehicular traffic, noted on the drawings. These slabs must have received an initial coat of the curing and sealing compound.

3.15 SHORES AND SUPPORTS

- A. Comply with ACI 347 for shoring and reshoring in multistory construction, and as herein specified.

3.16 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50°F (10°C) for 12 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28-days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.17 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- B. When forms are intended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

### 3.18 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in- place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
- D. Grout base plates and foundations as indicated using specified free-flowing non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.
- E. Where high fluidity and/or increased placing time is required use the specified high flow grout. This grout shall be used for all base plates larger than 10 square feet.
- F. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screeds, tamp, and finish concrete surfaces as scheduled.
- G. Reinforced Masonry: Provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

### 3.19 CONCRETE SURFACE REPAIRS

- A. Prior to all repairs, an as-built condition sketch and method of repair must be submitted to the Architect and Engineer of Record for review and approval.
- B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.
- C. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make

- edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with a bonding grout containing the specified bonding admixture. Place patching mortar after while bonding grout is still tacky.
- D. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
  - E. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discoloration's that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or pre-cast cement cone plugs secured in place with bonding agent.
  - F. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
  - G. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for tureens of slope, in addition to smoothness, using a template having required slope.
  - H. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
  - I. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days, except at hydrostatic slabs.
  - J. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. The specified underlayment compound or repair topping may be used when acceptable to Architect.
  - K. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
  - L. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cutout holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

Place dry-pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

- M. Structural Repair: All structural repairs shall be made with prior approval of the Engineer of Record as to method and procedure, using the specified polymer repair mortar and/or specified epoxy adhesive. Where epoxy injection procedures must be used, an approved low viscosity epoxy made by the manufacturers previously specified shall be used. In addition, all cracks shall be filled with the specified crack sealer or other method as approved by the Engineer of Record. All garage slabs shall be repaired prior to the slab being treated with the specified penetrating anti-spalling sealer.
- N. Underlayment Application: Leveling of floors for subsequent finishes may be achieved by use of specified underlayment material. Underlayment application shall achieve the tolerances specified in "MONOLITHIC SLAB FINISHES" above.
- O. Specified Polymer Horizontal Repair Mortar: All exposed floors shall be leveled, where required, with the specified self-leveling repair topping.
- P. Repair Methods not specified above may be used, subject to acceptance of Architect.

### 3.20 FOUNDATION WALLS

- A. The contractor shall form and leave openings in walls as shown on drawings and approved shop drawings for work of other contractors. These openings shall be temporarily closed and when so directed, the contractor shall point up in solid and neat manner with waterproofed cement.

### 3.21 WORK IN CONNECTION WITH OTHER TRADES AND CONTRACTS

- A. Sleeves, pockets, openings, etc., shall be set in the concrete walls and arches as required for the mechanical trades as shown on approved shop drawings; these shall be encased or built into the concrete work and shall be properly placed and secured in position in the forms before concrete is placed.
- B. Provide all chases, pipe slots, etc., required for the mechanical trades (see mechanical drawings), constructed as shown on the approved shop drawings.
- C. Leave temporary access panels where required to install mechanical equipment as required by trade affected. Panels shall be formed with construction joints as specified. Details for such panels shall be submitted to Architect for approval.
- D. Coordinate all penetrations, cutting, and patching with waterproofing contractor.

### 3.22 CUTTING AND PATCHING

- A. Contractor for concrete work shall be responsible for all cutting, removing and patching work where concrete surfaces are not installed within the limits shown on the drawings or

specified herein. All such work shall meet with the approval of the Architect or Engineer of Record.

- B. Where cutting and patching is required to accommodate the work of other subcontractors, such cutting shall be done at the expense of said subcontractors but shall be performed by the contractor for concrete work.
- C. The location and extent of cutting in completed concrete work and the patching thereof shall meet with the approval of the Architect or Engineer of Record.

### 3.23 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. The Owner will employ a testing laboratory to perform tests and to submit test reports.
- B. Provide special inspections per the applicable Building Code and the requirements of all applicable ACI standards.
- C. At locations previously indicated in this specification and on the contract drawings, verify the use of non-magnetic materials. No magnetic materials are permitted in locations where prohibited by this specification or the contract drawings.
- D. Sampling and testing for quality control during placement of concrete may include the following, as directed by Architect.
  - 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
  - 2. Slump: ASTM C 143; one test at point of discharge for each truck; additional tests when concrete consistency seems to have changed.
  - 3. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each truck of air-entrained concrete.
  - 4. Concrete Temperature: Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C) and above; and each time a set of compression test specimens made.
  - 5. Compression Test Specimen: ASTM C 31; one set of 5 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
  - 6. Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 25 cu. yds. plus additional sets for each 50 cu. yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimens tested at 7 days, three specimens tested at 28 days, and one specimens retained in reserve for later testing if required.
    - a. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.



- b. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
  - c. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
7. Water Cementitious Ratio Test: Check water content of concrete in accordance with AASHTO T 318 "Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying". Frequency of this test shall be the same as that of compressive strength tests, noted above.
  8. Floor Preparation to Receive Resilient Flooring: For any concrete that receives resilient flooring, test concrete in accordance with ASTM F 710 prior to acceptance by owner.
  9. Test results will be reported in writing to Architect, Engineer of Record, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.
    - a. Non Compliance: All test reports indicating non-compliance shall be faxed immediately to all parties on the test report distribution list and the hard copies submitted on different colored paper.
    - b. Nondestructive Testing: Windsor probes, sonoscope, or other non-destructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
  10. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

### 3.24 WASTE MANAGEMENT

- A. Separate and recycle waste materials in accordance with the Section 017419 Construction Waste Management and Disposal and to the maximum extent feasible.
- B. Collect cut off steel and discarded reinforcement steel and place in area for recycling.
- C. Place materials defined as hazardous or toxic waste in designated containers.
- D. Use trigger operated spray nozzles for water hoses and closed loop system to reduce water consumption.

- E. Reusable forms should be cleaned immediately after removal and non-reusable forms recycled to the maximum extent economically feasible.
- F. Incorporate crushed concrete or masonry materials in sub-base to the maximum extent feasible in accordance with sub-base specifications.
- G. Before concrete pours, designate location or uses for excess concrete. Options include:
  - 1. Additional paving
  - 2. Post footing anchorage
  - 3. Landscaping -- site concrete features
  - 4. Flowable fill
- H. To avoid contamination of the local landscape, before concrete pours, designate a location for cleaning out concrete trucks where run-off can be contained, reused or incorporated. Options include:
  - 1. Company owned site for that purpose
  - 2. On-site area to be paved later in project

END OF SECTION

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Section 03 33 01  
CAST-IN-PLACE CONCRETE - SITE

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. Requirements set forth herein are in addition to and shall be considered as complementary to the Terms and Conditions for Construction and the balance of Divisions 00 and 01 and Technical Specifications.
- B. All Contractors, Subcontractors, Vendors and the like shall be required to familiarize themselves with said provisions.

1.2 SUMMARY

- A. Work includes, but is not limited to, providing all labor, materials, equipment, and supervision to accomplish the following concrete work in accordance with the Drawings and Specifications:
  - 1. Construct new concrete paving slab-on-grade, as shown on the Contract Drawings.
  - 2. Construct new concrete walls, stairs and steps to receive veneer and capstones under the work of Division 04 Sections, as shown on the Contract Drawings.
  - 3. Construct new exposed to view miscellaneous site concrete as shown on the Contract Drawings.
  - 4. Construct new concrete foundations and footings for miscellaneous items, as shown on the Contract Drawings.

1.3 RELATED WORK UNDER OTHER SECTIONS

- A. Related Requirements:
  - 1. Section 011000 SUMMARY OF WORK.
  - 2. Section 013300 SUBMITTALS for general requirements.
  - 3. Section 024113 SELECTIVE SITE DEMOLITION.
  - 4. Section 079200 JOINT SEALANTS.

1.4 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. Install: Operations at the project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- C. Shop Drawing: Drawing or detail prepared by the Contractor, subcontractor, or supplier used to indicate the Contractor's understanding of the work or the Contractor's intended method of completing the work, for use by the Contractor, subcontractor, or supplier during fabrication, erection, installation, finishing, or otherwise performing the work, whether at the project site or at another location.

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## 1.5 REFERENCES

- A. The following references are incorporated into these Specifications. These written Specifications take precedence over incorporated references. The Contractor shall have the following references at the project site at all times and shall be familiar with the reference contents.
1. ACI 301 – ACI Specifications for Structural Concrete.
    - a. ACI 302 – Guide for Concrete Floor and Slab Construction.
    - b. ACI 304 – Guide for Measuring, Mixing, Transporting, and Placing Concrete.
    - c. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
    - d. ACI 305 – Recommended Practice for Hot Weather Concreting.
    - e. ACI 306R – Recommended Practice for Cold Weather Concreting.
    - f. ACI 308 – Standard Practice for Curing Concrete.
    - g. ACI 309 – Standard Practice for Consolidation of Concrete.
    - h. ACI 315 - Recommended Practice for Detailing Reinforced Concrete Systems
    - i. ACI 318 – Building Code Requirements for Reinforced Concrete.
    - j. ACI 347 – Recommended Practice for Concrete Formwork.
    - k. ACI 614 – Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete
  2. ASTM International (ASTM):
    - a. ASTM C33 – Concrete Aggregates.
    - b. ASTM C94 – Ready Mix Concrete.
    - c. ASTM C150 – Portland Cement.
    - d. ASTM C260 – Air-Entraining Admixtures for Concrete.
    - e. ASTM C494 – Chemical Admixtures for Concrete.
  3. CRSI – Placing Reinforcing Bars, Recommended Practices.

## 1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference Conducted at Project Site:
1. Review methods and procedures related to concrete repairs, including but not limited to, the following:
    - a. Concrete mixture designs.
    - b. Quality control of concrete materials and mixtures.
  2. Require representatives of each entity directly concerned with concrete work to attend, including the following:
    - a. Owner.
    - b. Owner's Representative(s).
    - c. Contractor's superintendent.
    - d. Concrete subcontractor
    - e. When requested by the Owner's Representative:
      - 1) Independent testing agency responsible for concrete design mixtures.
      - 2) Other trades involved to discuss the conduct of the work of this Section.
      - 3) Ready-mix concrete manufacturer.
- B. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishing, cold- and hot-weather concreting procedures, curing

procedures, construction and isolation joints, forms and form removal limitations, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified flatness, flatness and measurement, and concrete protection.

1.7 GUARANTEE

- A. Provide a written guarantee document stating that if, within 3 years after the Date of Substantial Completion of the Work, any of the work of this Section is found to be defective or not in accordance with the Specifications, the Contractor shall correct it promptly at no cost to the Owner. Also, it shall state that the Contractor shall bear all costs incurred by the Owner, including reasonable attorney's fees, to enforce compliance with the obligations of this Guarantee. The obligation of these Guarantees shall run directly to the Owner, may be enforced by the Owner against the Contractor, shall survive the termination of the Contract, and shall not be limited by conditions other than this Contract.

1.8 ACTION SUBMITTALS

- A. Make all submittals in accordance with the requirements of Section 013300 SUBMITTALS.
- B. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials.
- C. Submit the items listed in this section below to the Owner's Representative for approval in time to allow for review and resubmittals, if needed, without delaying the work. Do not order materials or start work before receiving the Owner's Representative's written approval for all submittals
- D. Product Data: For each type of product.
1. Manufacturer's Data Sheets.
  2. MSDS (SDS) Sheets.
- E. Concrete mix design for each type of concrete. The Contractor shall warrant by the submission of the design mixes that such mixes are totally representative of the concrete that he intends to supply to meet the requirements of the Contract Documents. Submit new design mixes for review and approval when any change in materials is required or needed. Include the following information for each concrete mix design:
1. Mix identification designation (unique for each mix submitted).
  2. Statement of intended use for mix.
  3. Method used to determine the proposed mix design.
  4. Compressive Strength at Seven and Twenty-Eight Days: Submit strength test records, mix design materials, conditions, and proportions for concrete used for record of tests, standard deviation calculation, and determination of required average compressive strength. The submission shall be in accordance with ACI 318.
  5. Gradation of Fine and Coarse Aggregates: Testing data confirming proposed coarse aggregate meets ASTM C33 class designation. Include ASTM test results for aggregates subject to freeze-thaw environment.

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6. Proportions of all ingredients, including all admixtures to be added either at the time of batching or at the jobsite.
  7. Water-to-cementitious-materials ratio.
  8. Slump tested in accordance with ASTM C143.
  9. Air content of freshly mixed concrete by the pressure method, ASTM C231, or the volumetric method, ASTM C173.
  10. Unit Weight of Concrete: ASTM C138.
  11. Written certifications of the following:
    - a. Mill test reports of portland cement chemical and physical analysis and certification of compliance with ASTM C150 Type I/II.
    - b. Mill test reports of fly ash chemical and physical analysis and certification of compliance with ASTM C618 Class C or F, if used.
    - c. Mill test reports of slag chemical and physical analysis and certification of compliance with ASTM C989, if used.
  12. Manufacturer's Spec Data Sheets of each concrete admixture, including brand name, manufacturer, and dosage rate range.
  13. Written certification of aggregate compliance with ASTM C33, including all restrictions on reactive materials, with the additional provision that the effectiveness of the use of a cement with less than 0.60% alkalis (sodium-oxide equivalent) or other mitigation methods shall be demonstrated by ASTM C1260, ASTM C1567, and/or ASTM C1293 testing or the aggregate shall have a demonstrated satisfactory performance history prior to acceptance.
- F. Concrete mixing, placement, sloping and grade control, curing, and protection procedures.
- G. Steel Reinforcement Shop Drawings: Provide drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Shop drawings shall be reviewed and approved Owner's Representative prior to fabrication.
- H. Concrete Placement Drawings: Drawing showing the layout and schedule of concrete placements; coordinate this drawing with the Joint Plan drawing, or show placement information on the Joint Plan drawing.
- I. Joint Plan: Drawing showing the layout and type of required joints, including isolation joints.
  1. Location of construction joints is subject to approval of the Owner's Representative.
- J. Shop Drawings of block-out at top of typical expansion joint, based on approved mockup constructed under Section 079200.
- K. Project Schedule and Phasing Plan: Submit a project schedule and phasing plan prior to the start of the Work and every week throughout the duration of the project to reflect the status of the Work. Include in the project schedule a plan of the work area that shows the construction work area, pedestrian walkways, employee walkways, and delivery areas.
- 1.9 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer, manufacturer, and testing agency.

- B. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.
  - 1. Submit formwork shop drawings.
  - 2. The Shop Drawings shall bear the seal of the professional engineer licensed to practice in the State of New York who is responsible for determining the need for and designing the shoring system. The Shop Drawings shall include, without limitation, the shoring system layout and details. The Shop Drawings shall be based on actual field measurements of the existing structural elements.
- C. Submit a list of equipment intended for use on the Work.
- D. Field quality-control reports.
- E. Minutes of preinstallation conference.

#### 1.10 GENERAL PROCEDURES

- A. Work only in areas permitted by the Owner-approved schedule.
- B. Do not stockpile materials, debris, or equipment.
- C. Deliver materials to the site only in manufacturer's original containers, clearly marked with legible, intact labels with manufacturer's name and brand name and identifying contents of containers.
- D. Store materials in areas where temperatures and conditions conform to the manufacturer's recommendations and instructions.
- E. Replace materials damaged during handling or storage. Remove damaged materials from the premises immediately.
- F. Protect the existing utility systems or any systems that are to remain and to be in service during construction from all risks associated with the work in this Section. Schedule and execute all work without exposing the areas beyond the boundary of the construction to water, dust and debris, or materials used by this Contractor. Protect items described above from damage and stains with appropriate barriers and masking. Repair all damage as a result of the work of this Section to its condition at the start of work, or if such cannot be determined, to its original condition, at no cost to the Owner. Clean all stains by approved means.
- G. Protect the work from damage such as impact, marring of the surfaces, and other damage.
- H. Compliance with OSHA and all other safety laws and regulations is the exclusive responsibility of the Contractor, his subcontractors, suppliers, consultants, and servants.

#### 1.11 ENVIRONMENTAL REQUIREMENTS

- A. Do not place portland cement concrete when the base surface temperature is less than 40°F (4°C).

#### 1.12 QUALITY CONTROL AND QUALITY ASSURANCE

- A. Perform concrete work in accordance with the following, unless modified by requirements in the Contract Documents:
1. ACI 301 – Specifications for Structural Concrete.
  2. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
- B. Welding: Provide the following for each welded joint, all to comply with the requirements of AWS D1.1/D1.1M, "Structural Welding Code – Steel."
1. Welding Procedure Specifications (WPSs), Welder Qualification Records (WQRs), and Procedure Qualification Records (PQRs) for all welds.
- C. The Contractor shall conduct a quality control program that includes, but is not limited to, the following:
1. Inspection of all materials to ensure conformity to Contract requirements and that all materials are new and undamaged.
  2. Establishment of procedures for executing the work.
  3. Inspecting all reinforcement for placement in plan and elevation.
  4. Inspection of work in progress to ensure that work is being done in accordance with established procedures; manufacturer's instructions; specific Owner's Representative instructions, if given; or recommended practices as given in the references of Para. 1.3.
- D. Qualifications:
1. The Contractor and its site superintendent shall have at least 5 years of experience supervising the installation of similar concrete specified in this Section.
  2. Installer Qualifications: All flatwork placement crews shall include personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
  3. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
    - a. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- E. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
1. Personnel conducting field tests shall be ACI-certified Concrete Field Testing Technician, Grade I, or an equivalent certification program.
  2. Personnel performing laboratory tests shall be ACI-certified Concrete Laboratory Testing Technician – Level 1. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician – Level 2.
- F. Preinstallation Conference:
1. Attend a preinstallation conference to be held with a representative of the Owner, Owner's Representative, General Contractor's field superintendent, foreman, and other trades involved to discuss the conduct of the Work of this Section.
- G. Mockups:



1. The Contractor shall install mockups in a trial area designated by the Owner's Representative to demonstrate that the equipment, personnel, and methods of installation are capable of producing results and finish satisfactory to the Owner's Representative. The mockups shall consist of:
  - a. Paving Slab-on-Grade: At least one area of 30 ft by 30 ft or sized as directed by the Owner or Owner's Representative.
2. The mockups shall be constructed in the same manner as intended for the remaining work. The Owner's Representative shall observe the prepared surfaces, reinforcement, and the installation of the new paving concrete slabs. The Owner and Owner's Representative shall review the color, finish, and texture of the mockup.
3. If necessary, the mockups shall be repeated at no additional cost until it can be installed successfully and the color, finish, and texture of the exposed concrete surface are approved.
4. Demolish and remove mockups when directed by the Owner.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

H. Quality Assurance Testing during Construction:

1. General: The Owner will employ an independent Testing Agency to perform tests and to submit test reports. The Owner's Testing Agency will conduct the following quality assurance tests at any time and location:
  - a. Sampling and testing of ready-mix concrete for slump, air content, and seven- and twenty-eight-day compressive strengths.
  - b. Examining new concrete for any defective work, such as cracking, honeycombing, etc.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement

1.14 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  1. When average high and low temperature is expected to fall below 40°F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
  4. Protection against cold weather, including concrete mixture acceleration, insulation, heat systems, enclosures, or a combination of all such practices shall be planned for well in advance of concrete placement. Maintain protection measures in place until minimum compressive strength has been achieved.
- B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90°F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided that the water equivalent of the ice is included in the total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist, without standing water, soft spots, or dry areas

#### 1.15 BASIS OF PAYMENT

- A. All the work associated with new concrete construction shall be paid for at the contract lump-sum prices for the following items:
  1. Concrete paving slab-on-grade.
  2. Concrete foundations.
  3. Concrete footings.

### PART 2 - PRODUCTS

#### 2.1 FORM MATERIALS

- A. Earth Forms: Earth forms will not be permitted for vertical surfaces.
- B. Exposed-to-View Surfaces:
  1. Use new Class 1 B-B High Density Overlaid Plyform, exterior grade, not less than five ply nor less than 5/8 inch thick conforming to U.S. Product Standard P-1-83. Design and maintain forms in accordance with instructions in American Plywood Association (APA) Manual "Concrete Forming" (Form No. V345N/Revised June 87/5000).
  2. Forms for Textured Finish Concrete: Form textured finish concrete surfaces with units of face design, size, arrangement and configuration as shown on drawings or as required to match Owner's Representative's control sample. Provide solid backing and form supports to ensure stability of textured form liners.
  3. Cylindrical Columns and Supports: Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.
- C. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- D. Not-exposed-to-view Concrete Surfaces: Use forms of wood, metal, or other material subject to approval of Owner's Representative.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 in., minimum. Nailed six inches on center and installed in inside corners of all forms, unless otherwise indicated or otherwise directed by the Owner's Representative.
- F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
  3. Ties for concrete exposed to public view shall have removable set-back cones.
  4. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
- H. Where indicated, isolation and expansion joint filler shall be ANSI/ASTM D1752 preformed sponge rubber or cork, 1/2 in. thick.

## 2.2 PLASTIC SHEET FOR SLABS ON GRADE

- A. Provide plastic barrier over prepared base material beneath slabs on ground. Use only materials that are resistant to decay when tested in accordance with ASTM E154. Use polyethylene sheet not less than 10 mils thick or approved equivalent.

## 2.3 WATERSTOP MATERIALS

- A. Waterstops: Provide one of the following types of waterstops where shown on the drawings:
1. Provide flat, dumb-bell type or centerbulb type waterstops at construction joints and other joints as indicated, of size to suit joints. Waterstops shall be rubber neoprene conforming to Corps of Engineers CRD-C513 or PVC conforming to CRD-C572. Install in accordance with manufacturer's instruction. Use products manufactured by one of the following or equivalent:
    - a. Afco Products.
    - b. W.R. Meadows.
    - c. Williams Products.
- B. Provide laminate of bentonite and high-density polyethylene, such as "Parastop" by Paramount Technical Products, between the contact faces of construction joints. Install in strict accordance with manufacturer's instructions.

## 2.4 CONCRETE MATERIALS

- A. Portland cement: ASTM Specification C150, Type I/II, Grey or White, of same type, brand, and source. Use only one brand of cement for each type of cement throughout project. No visual variations in color shall result in exposed concrete.
- B. Fly Ash: ASTM C618, Class F.
- C. Slag: ASTM C989, Grade 100 or 120.
- D. Normal-Weight Aggregates:

1. Sand shall consist of washed, clean, hard, uniformly graded natural silica sand in accordance with ASTM C33.
  2. Coarse aggregate shall be nominal 3/4 inch maximum size, with distribution per ASTM C33, Table II, clean, and well graded.
  3. All aggregate shall be certified by the supplier as being nonreactive in accordance with ASTM C1260, ASTM C1567, and/or ASTM C1293 or shall have a demonstrated satisfactory performance history.
- E. Water: Clean, potable water, free of contaminants and in conformance with the requirements of ASTM C94.
- F. Admixtures: Provide admixtures that are certified by the manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete, with written documentation. Do not use calcium chloride or admixtures containing calcium chloride. All admixtures must be approved in writing by the Owner's Representative prior to use. Manufacturer(s) approval for the use of all admixtures in combination must be submitted to the Owner's Representative prior to use.
1. Air-entraining admixture: shall comply with ANSI/ASTM C 260.
    - a. "Daravair", W.R. Grace & Co.
    - b. "Airmix or Perma-Air", The Euclid Chemical Co.
    - c. "MB-VR", Master Builders Co.
    - d. Or approved equivalent.
  2. Silica fume admixture: shall be supplied in slurry form as one of the following and in strict accordance with manufacturer's instructions; use water-fog misting or evaporation retarder immediately after floating flatwork containing silica fume:
    - a. "Force 10,000", W.R. Grace & Co.
    - b. "MB-SF", Master Builders.
    - c. "Sikacrete 950", Sika Corp.
    - d. Or approved equivalent.
  3. Evaporation retarder: use water-based monomolecular film; use one of the following with flatwork containing corrosion inhibitor or silica fume admixture:
    - a. "Confilm", Master Builders.
    - b. "Euco-bar", Euclid Chemical Co.
    - c. "E-Con", L & M Construction Chemicals
    - d. Or approved equivalent.
  4. Mid-range water-reducing admixture: ASTM C494, Type A. Subject to compliance with requirements, provide one of the following:
    - a. "Darcem-55", W.R. Grace & Co.
    - b. "Mid-Range Water Reducer", Master Builders Co.
    - c. "Eucon X26", The Euclid Chemical Co.
  5. High-Range Water Reducing (HRWR) admixture (Super Plasticizer): shall comply with ASTM C494, Type F or Type G and contain not more than 0.05% chloride ions:
    - a. "WRDA 19", W.R. Grace & Co.
    - b. "Daracem 100", W.R. Grace & Co.
    - c. "Eucon 37", Euclid Chemical Co.
    - d. "Sikament", Sika Chemical Corp.
    - e. "Rheobuild-1000", Master Builders Co. f. Or approved equivalent.

6. Water-reducing Set Retarders: shall conform to ASTM C494 Type D and may be used when ambient temperatures exceed 80 degrees F. Use one of the following or equivalent:
  - a. "Daratard-17"; W.R. Grace.
  - b. "Eucon Retarder"; Euclid Chemical Co.
  - c. Pozzoloth 100-XR"; Master Builders.
7. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
8. Shrinkage-Reducing Admixture: ASTM C494, Type S, such as the following:
  - a. Eucon SRA+ by Euclid Chemical Co.
  - b. Sika Control 40 by Sika.
  - c. Eclipse 4500 by W.R. Grace.
  - d. Approved equivalent.
9. Corrosion Inhibitor admixture: calcium nitrite based inhibitor shall comply with AASHTO M194 Type C, such as W.R. Grace "DCI Corrosion Inhibitor" or approved equivalent at the rate of 3.0 gallons per cubic yard of concrete. Use water-fog misting or evaporation retarder immediately after floating flatwork containing corrosion inhibitor.

## 2.5 REINFORCEMENT:

- A. Unless otherwise noted in the Contract Documents, reinforcing bars shall conform to ASTM A615, Grade 60, deformed. Bars shall be bent cold.
- B. Welded Wire Fabric: shall conform to ASTM A185 and shall be fabricated from sheets or fully flattened from rolls.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete. Use plastic tips on all chairs in contact with concrete formwork.
- D. Tie Wire: No. 16 gauge annealed, plastic coated.
- E. Epoxy-coated reinforcing: epoxy coat reinforcing bar steel and welded wire fabric so designated on the drawings after fabrication in compliance with ASTM A-775. Inspect epoxy coated reinforcing for compliance with ASTM A-775 and tag the reinforcing with the name of the epoxy facility, the ASTM number and coating thickness. A notarized Certificate of Compliance with all of the above shall be required from the epoxy facility. In accordance with CRSI Engineering Data Report No. 19, use special procedures during handling, storage and installation to prevent scarring epoxy coating.
- F. Reinforcement Accessories: Reinforcement accessories shall include spacers, chairs, ties, slab bolsters, clips, chair bars, and other devices for properly assembling, placing, spacing, supporting, and fastening reinforcement. Tie wire shall be annealed wire of sufficient strength for intended purpose, but not less than No. 18 gage. Bar supports shall conform to Chapter 3, "Bar Supports" or CRSI Manual of Standard Practice. Supports touching interior formed surfaces exposed to view shall be CRSI Class 1, plastic protected. When epoxy coated reinforcing is used, accessories shall be epoxy coated and tie wire shall be nylon, epoxy or plastic coated.

- G. Dowel Bars: Install dowel bars as indicated in Drawings.
  - 1. Dowel bars shall be 1 in. diameter uncoated steel or equivalent substitute.
  - 2. Secure in position using baskets or similar alignment devices when cast in place.
- H. Adhesive for Reinforcing Bar Dowels and Adhesive Anchors:
  - 1. Hilti HIT-HY 200 Epoxy Adhesive, Hilti, Inc., Tulsa, Oklahoma.
  - 2. Approved Equivalent.
- I. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.
  - 1. Hilti Kwik Bolt TZ, Hilti, Inc., Tulsa, Oklahoma.
- J. Stainless-Steel Bolts and Nuts: Hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F593 for bolts and ASTM F594 for nuts, Alloy Group 2, 316.

## 2.6 JOINTING MATERIALS

- A. Expansion Joint Filler: ANSI/ASTM D1752 preformed sponge rubber or cork, 1/2 in. (12 mm) thick.
- B. Joint Sealants as specified in applicable Division 07 Sections.

## 2.7 RELATED MATERIALS

- A. Vapor Retarder: Provide Class A vapor barrier over rigid insulation beneath slabs on ground. Use only materials which have a moisture transmission rate of less than 0.01 grains per square foot per hour and meet the requirements of ASTM E1745 and ASTM E1643. Use polyethylene sheet not less than 15 mils thick or approved equivalent such as the following:
  - 1. "Vapor Block VB15" By Raven Industries
  - 2. Griffolyn "15-mil Green" by Reef Industries
  - 3. "15 mil Stego Wrap" by Stego Industries
- B. Non-shrink Grout: Use CRD-C 621, factory pre-mixed grout, Type D, non-metallic, such as one of the following or an approved equivalent:
  - 1. "Masterflow 928"; Master Builders.
  - 2. "Euco-NS"; Euclid Chemical Co.
  - 3. "Five Star Grout"; Five Star Products.
- C. Non-slip Aggregate Finish: Use fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40% aluminum oxide and not less than 25% ferric oxide. Use material that is factory-graded, packaged, rust-proof and nonglazing, and is unaffected by freezing, moisture and cleaning materials.

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- D. Absorptive Cover: Use burlap cloth weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- E. Moisture-Retaining Cover: One of the following, complying with ASTM C171:
1. Polyethylene-coated, blended polyester fabric.
    - a. HydraCure Wet Curing Cover, PNA Construction Technologies, Inc., 9 Dunwoody Park, Suite 111, Atlanta, GA 30338.
  2. Polyethylene film.
  3. Polyethylene-coated burlap.
  4. Use of curing compounds is strictly prohibited.
- F. Curing Compounds: Verify that products listed below meet regulations of jurisdiction for Volatile Organic Compounds (VOC) emissions. Notify Owner's Representative if listed products do not comply and submit information about equivalent products that do comply.
1. Curing and Sealing Compound: Use a clear acrylic type conforming to ASTM C309, Type I, Class B. Use one of the following or equivalent where concrete surfaces will remain exposed. a. "Masterkure"; Master Builders. b. "Super Rez Seal"; Euclid Chemical Co. c. "Dress & Seal #30"; L & M
  2. Curing and Hardening Compound: Use colorless solution containing 35% of a 42 degree Baume sodium silicate solution. Use where shown on drawings. Use one of the following or equivalent: a. "Chem-Hard"; L & M b. "Eucosil" Euclid Chemical Co. c. "Cure-hard"; W.R. Meadow
  3. Dissipating Resin Curing Compound: Use a dissipating resin type compound, conforming to ASTM C309, Type I. The film must chemically break down in a two-to-four week period. Use one of the following or equivalent where concrete surfaces will receive other materials: a. "Kurez DR"; Euclid Chemical Co. b. "3100"; W.R. Meadows c. "Cure Resin"; L & M
- G. Bonding Agent, Patching Mortar: Cementitious slurry containing polymer-modified latex admixture, such as one of the following:
1. "SikaTop 121, 122 or 123"; Sika Corporation
  2. "Flexcon"; Euclid Chemical Co.
  3. "Everbond"; L & M
- H. Threaded Inserts: Use galvanized structural concrete inserts of type shown on the drawings, similar and equivalent to strut and loop inserts with coil-threaded rods as supplied by Richmond Screw Anchor, having yield strength  $F_y = 85,000$  psi.
- I. Expansion Bolts: Use hot-dipped galvanized bolt conforming to Federal Spec. FF-S-325, Group II, Type 4, Class 1. Allowable pullout and shear values shall be based on ASTM E 488 test methods. See Drawings for diameters, edge distances, embedments and center-to-center spacings. Use one of the following or equivalent approved by Owner's Representative:
1. "Kwik Bolt TZ"; Hilti Inc.
- 2.8 MIX PROPORTIONS
- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301 and ACI 318. For the trial batch

method, use an independent testing agency acceptable to Owner's Representative for preparing and reporting proposed mix designs.

1. Do not use the same testing agency for field quality-control testing.
  2. Submit written reports to the Owner's Representative of each proposed mix for each class of concrete at least fifteen days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed and approved by the Engineer of Record.
- B. Design mixes to provide normal-weight concrete with the following properties as indicated on Drawings and schedules:
1. Total Cementitious Content: 725 lbs/cu yd, maximum.
    - a. If a low-alkali cement is used to address potential aggregate reactivity, its effectiveness shall be demonstrated by testing according to ASTM C1567.
    - b. Limit use of fly ash in concrete exposed to deicing chemicals in service to not exceed 25% of cement content by weight. If fly ash contents above 25% are required for reactive aggregate mitigation, provide ASTM C666 testing results indicating satisfactory performance.
  2. Limit water-soluble, chloride-ion content in hardened concrete to 0.15% by weight of cement.
  3. Foundations, walls and slabs not exposed to weather: Twenty-Eight-Day Design Compressive Strength: 3,000 psi.
  4. Foundations, walls and slabs exposed to weather: Twenty-Eight-Day Design Compressive Strength: 4,000 psi.
  5. Slabs, sidewalks, steps and stairs exposed to weather: Twenty-Eight-Day Design Compressive Strength: 5,000 psi.
  6. Air Content: Total 6-1/2% with a tolerance of  $\pm 1\text{-}1/2\%$  (5% to 8%) based on 3/4 inch maximum-sized aggregate. If another coarse-aggregate size is used, the air content will need to be adjusted to meet minimum air contents as identified in ACI 318 for severe exposure.
  7. Slump Limits: 5 to 7 in.
  8. Water to Cementitious Materials Ratio: W/CM shall be 0.40 or less.
  9. Shrinkage Control: The concrete paving slab on structural slab shall:
    - a. Contain shrinkage-reducing admixture: manufacturers' recommended dosage, with a minimum dosage of 1.5 gal/cu yd (or a quantity shown to be sufficient to result in a shrinkage of 0.05% or less when measured in accordance with ASTM C157 modified to include only seven days of wet curing prior to drying)
  10. Corrosion Inhibitor: The concrete shall contain a dosage of 1.0 gal/cu yd of corrosion inhibitor.
  11. Do not use calcium chloride.
  12. Use accelerating admixtures in cold weather only when approved by the Owner's Representative. Use of admixtures will not relax cold-weather placement requirements.
  13. Use set-retarding admixtures during hot weather only when approved by the Owner's Representative.
- C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Owner's Representative. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Owner's Representative before using in Work.



- D. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.
  - 1. When air temperature is between 85-degrees and 90-degrees Fahrenheit, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90-degrees Fahrenheit, reduce mixing and delivery time to 60 minutes.
  - 2. Provide a batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.
- E. Concrete shall be vibrated and compacted properly to ensure it can flow freely around the reinforcement and into the formwork without creating areas of honeycombing, segregation, or incomplete filling.

## 2.9 EQUIPMENT

- A. Pumping Equipment:
  - 1. The pump for placing the concrete shall be compatible with the material being placed, sized to the quantity of material being installed at any one time, and available for use when needed. All pumping equipment shall have adequate controls to regulate flow rates.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine work prepared by other trades to receive work of this Section and report any defects affecting installation to the Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.
- B. Notify the Owner's Representative immediately and in writing of any discrepancies between the Drawings and field conditions or of incompatibilities with the desired grades, specified thicknesses, and existing elevation constraints. Do not start work until all discrepancies and incompatibilities have been resolved.

### 3.2 HANDLING, STORAGE, AND PROTECTION OF MATERIALS

- A. Handle and store materials separately in such manner as to prevent intrusion of foreign matter, segregation, or deterioration. Do not use foreign materials or those containing ice. Remove improper and rejected materials immediately from point of use. Cover materials, including steel reinforcement and accessories, during construction period. Stockpile concrete constituents properly to assure uniformity throughout project.

### 3.3 REINFORCEMENT AND DOWELS

- A. Install reinforcement and dowels as indicated in the Contract Drawings.
- B. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

- C. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- D. Accurately position, support, and secure reinforcement and dowels against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars. Use "sand feet" or equivalent protection under all reinforcing bar supports to prevent damage to underlying materials.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Install epoxy anchors in accordance with the manufacturer's recommendations at locations shown on Contract Drawings.
- G. Place reinforcement in accordance with ACI 117 (Tolerances) and with Contract Documents and secure firmly in position by wire ties, chairs, spacers, and hangers, each of type approved by Owner's Representative.
- H. Welding Reinforcement: Comply with AWS D1.4-98 for welding practices. Preheat and interpass temperatures shall comply with Table 5.2 of AWS D1.4-98. Provide mill reports to Owner's Representative showing carbon content of reinforcing being welded.
- I. Do not bend, tack-weld or cut reinforcement in field in any manner other than as shown on Drawings unless specific approval for each case is given by Owner's Representative.
- J. Continue reinforcement through construction joints unless otherwise indicated on Drawings.
- K. Splice reinforcement only in accordance with requirements of Contract Documents or as otherwise specifically approved by Owner's Representative. Do not splice reinforcement at points of maximum stress unless shown on the Drawings. Welded wire fabric shall be lapped six inches or one and one-half spaces, whichever is larger, and shall be wired together.
- L. At time concrete is placed, reinforcement shall be free of excessive rust, scale, or other coatings that will destroy or reduce bond. Paint reinforcement expected to be exposed to weather for a considerable length of time with a heavy coat of cement grout. Protect stored materials so as not to bend or distort bars in any way. Bars that become damaged will be rejected. Repair damage to coating of epoxy coated rebars in strict accordance with epoxy manufacturer's published instructions.
- M. Before concrete is cast, check all reinforcement after it is placed to insure that reinforcement conforms to Contract Documents and approved Shop Drawings. Such checking shall be done only by qualified experienced personnel. In addition, notify the Owner's Representative at least 36 hours prior to concrete placement so a visit may be made to observe completed reinforcement and formwork before concrete placement.

#### 3.4 TOLERANCES

- A. Slope the surface of the new concrete paving slab in accordance with the Contract Drawings. All sloped surfaces shall positively drain.
- B. Remedial work necessary for correcting construction not conforming to specified tolerances is the responsibility of the Contractor. Erected work that does not meet

specified tolerance limits shall be remedied or removed and replaced at Contractor's expense.

- C. If not otherwise indicated, provide minimum concrete surface flatness of FF = 30, when measured according to ASTM E1155.
- D. Surface elevations shall have a tolerance of  $\pm 1/4$  in.

### 3.5 FORMWORK

- A. Design, construct and remove formwork, shoring and bracing to meet design requirements so that resultant concrete conforms to required shapes, lines and dimensions.
- B. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until the structure can support such loads.
- C. Construct formwork so that concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- D. Construct forms tight enough to prevent loss of concrete mortar. At construction joints, overlap and clamp forms (using gaskets if necessary) to prevent offsets or loss of mortar at joints.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete. Before reusing form materials, thoroughly clean surfaces that will be in contact with freshly cast concrete, repair damaged areas and withdraw projecting nails. Recoat form with release agent. Reuse of form material for architecturally exposed concrete shall be subject to approval by Owner's Representative.

- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- L. Do not apply form release agent where concrete surfaces are scheduled to receive special finishes or coverings that may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

### 3.6 MIXING, CONSISTENCY, AND DELIVERY OF CONCRETE

- A. Use ready-mixed concrete produced by plant acceptable to Owner's Representative. Hand or site mixing shall not be done. Batch constituents, including admixtures, at central plant. Admixtures shall be premixed in solution form and dispensed as recommended by manufacturer.
- B. Concrete shall arrive at the job site at a slump of 2 to 3 inches and at the time of deposit shall be as follows:
  - 1. If high-range water reducing admixture (superplasticizer) is used, it may be added at the job site after verifying that the delivery slump is 2 to 3 inches. Maximum slump after adding HRWR shall be 8 inches.
  - 2. For normal weight concrete, water may be added at the site only to make up water withheld at the plant. Batching plant shall document on the driver's delivery ticket any water withheld at the plant. When water has not been withheld and slump is too low for proper handling of concrete, use HRWR to bring slump within specified range.
- C. Transport ready mixed concrete to site in watertight agitator or mixer trucks loaded not in excess of rated capacities. Discharge at site within one and one-half hours after cement was first introduced into mix. Do not use concrete with a temperature greater than 85 degrees Fahrenheit. Central mixed concrete shall be plant mixed a minimum of five minutes. Agitation shall begin immediately after premixed concrete is placed in truck and shall continue without interruption until discharged. Transit mixed concrete shall be mixed at mixing speed for at least ten minutes immediately after charging truck followed by agitation without interruption until discharged.
- D. Do not retemper (mixing with or without additional cement, aggregates, or water) concrete which has partially hardened.

### 3.7 REMOVING AND REUSING FORMS

- A. General: Formwork for Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50°F (10°C) for 24 hours after concrete placement. Concrete shall be hard enough not to be damaged by form-removal operations, and curing and protection operations must be maintained.
- B. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 80% of its twenty-eight-day design compressive strength.

- C. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- D. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- E. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by the Owner's Representative.

### 3.8 JOINTS

- A. General: Construct joints true to line with faces perpendicular to the surface plane of the concrete.
- B. Construction Joints: Install so that strength and appearance of concrete are not impaired, at locations indicated or as approved by Owner's Representative.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
  - 2. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 3. Use a bonding grout at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Paving Slab: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth as shown on Drawings:
  - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
  - 2. Contraction Joint Locations:
    - a. Contraction joints in concrete paving slab shall be spaced at no more than 12-feet zero-inches on center, each way.
    - b. Trench drain lines act as contraction joints.
    - c. Existing expansion joints in buried structure must have contraction joints in paving slab above.
    - d. Edges of buried structure must have contraction joints in paving slab above.
    - e. Where possible, the contraction joints should be:
      - 1) Orthogonal.
      - 2) Spaced at no less than 6-feet 6-inches on center.
      - 3) Evenly spaced.
      - 4) Approximately square, creating panels with no more than a 1:1.5 aspect ratio.
- D. Isolation or Expansion Joints in Paving Slab: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

- E. Doweled Joints: Install dowel bars at joints where indicated. Where shown on Drawing, lubricate or sleeve one-half of dowel length to prevent concrete bonding to one side of joint.

### 3.9 OPENINGS

- A. Openings for passing through concrete: Contractor shall establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections. Contractor shall be held responsible for proper coordination of all work of this nature in order that there will be no unnecessary cutting and patching of concrete. Any cutting and repairing to concrete required as a result of failure to provide for such openings shall be paid for by the Contractor at no additional expense to the Owner.

### 3.10 INSTALLATION OF EMBEDDED ITEMS

- A. Conform to requirements of ACI-318, paragraph 6.3, "Conduits and Pipes Embedded in Concrete", and as specified below.
- B. Install steel sleeves, furnished by other trades, at locations shown on the drawings.
- C. Install anchor bolts for column baseplates in accordance with AISC Code of Standard Practice, Paragraph 7.5 and the following: Use setting plate templates. Maintain elevations and plan locations of bolt groups within one-quarter inch of the locations shown on the drawings. Place individual bolts in a bolt group within one-eighth inch of center-to-center dimensions shown on the drawings.

### 3.11 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before placing concrete, verify that installation of plastic sheet and its laps and terminations are in place and intact.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless water is held back at the batch plant and the amount of water held back is indicated on the batch ticket. Do not add more water than the amount that is indicated on the batch ticket as being held back. Any such water shall be added before test sampling and placement of concrete.
- D. Remove water and foreign matter from forms and excavations and, except in freezing weather or as otherwise directed, thoroughly soak wood forms just prior to placing concrete. Place no concrete on frozen soil and provide adequate protection against frost action during freezing weather.
- E. To secure bond at construction joints, thoroughly clean concrete surfaces with water jet or compressed air. Before new concrete is deposited, saturate joint surface with water.
- F. Do not place concrete having slump outside of allowable slump range. The loss of slump between pump and discharge end of pipeline shall not exceed two inches.
- G. Transport concrete from mixer to place of final deposit as rapidly as practical by methods which prevent separation of ingredients and displacement of reinforcement, and which

avoid re-handling. Deposit no partially hardened concrete. When concrete is conveyed by chutes, equipment shall be of such size and U-shaped design as to insure continuous flow in chute. Do not use flat (coal) chutes. Use metal or metal lined chutes with different portions having approximately the same slope. Slope shall not be less than 25 degrees nor more than 45 degrees from horizontal. Use a baffle or spout at the discharge end of the chute to prevent segregation. If discharge end of chute is more than five feet above surface of concrete in forms, use spout with its lower end at surface of deposit. When operation is intermittent, discharge chute into hopper. Do not allow concrete to flow horizontally over distances exceeding five feet.

- H. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete so as to avoid segregation.
1. Deposit concrete in horizontal layers of depth so as to not exceed formwork design pressures and in such a manner as to avoid inclined construction joints.
  2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  3. During and immediately after depositing, compact concrete in accordance with ACI 309 by means of internal type mechanical vibrators or other tools to produce required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be carried on only enough to produce homogeneity and optimum consolidation without permitting segregation of constituents or "pumping" of air. Vibrators used for normalweight concrete shall operate at speed of not less than 7,000 rpm and be of suitable capacity. Do not use vibrators to move concrete. Keep at least one vibrator on hand for every 10 cubic yards of concrete placed per hour, plus one spare. Vibrators shall be operable and on site prior to starting placement.
  4. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate the placed layer and at least 6 inches into the preceding layer to limit the appearance of pour liens. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- I. Deposit and consolidate concrete in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Maintain reinforcement in position on chairs during concrete placement.
  3. Slope surfaces uniformly to drains where required.
  4. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- J. Cold joints, particularly in exposed concrete, including "honeycomb", are unacceptable. If they occur in concrete surfaces exposed to view, Owner's Representative will require that entire section in which blemish occurs be removed and replaced with new materials at Contractor's expense.
- K. When placing exposed concrete walls or columns, strike corners of forms rapidly and

repeatedly from outside along full height while depositing concrete and vibrating.

- L. Clean chutes, hoppers, spouts, adjacent work, etc. before and after each run; discharge water and debris outside form.
- M. Follow ACI recommendations for Hot Weather Concreting (ACI 305R) and Cold Weather Concreting (ACI 306R) as required by ambient conditions.
- N. Ensure that plastic sheet and its laps and terminations remain intact during concrete placement and do not allow concrete to fill the drainage composite.

### 3.12 FINISHING FORMED SURFACES

#### A. Finish of Formed Surfaces:

- 1. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work. This is the concrete surface imparted by stock form facing material used with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.
- 2. Smooth Form Finish: For formed concrete surfaces exposed-to-view and surfaces that are to be covered with a coating material applied directly to concrete, such as waterproofing, dampproofing paint. This is the as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of joints and with a systematic pattern of ties with set-back cones. Grout tie holes; remove and rub smooth fins or other projections. Surfaces remaining exposed-to-view shall have uniform color and texture acceptable to the Owner's Representative.
- 3. Related Unformed Surfaces: At tops of walls, horizontal offsets surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces.
- 4. Rubbed Finish: Apply the following finish to smooth-formed-finished as-cast concrete where indicated:
  - a. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

### 3.13 FINISH FOR WALLS AND CONCRETE STAIR TREADS

#### A. Walls and Stair Treads:

- 1. After screeding, consolidating, and leveling concrete, do not work surface until ready for floating. Begin floating when surface water has disappeared and when concrete has stiffened sufficiently to hand float. Check and level surface plane to a tolerance not exceeding 1/4-inch in 10-feet when tested with a 10-foot straightedge. Uniformly slope surface to drain.
- 2. Stair treads with smooth float finish: Immediately after sloping treads to drain, refloat surface to a uniform, smooth, granular texture that is slip resistant and planar.
- 3. Stair treads with non-slip broom finish
  - a. Apply non-slip broom finish to stair treads.



- b. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate final finish with the Owner's Representative prior to application.
- 4. Walls:
  - a. For horizontal, exposed-to-view tops of walls (or for horizontal wall surfaces to be covered with membrane or elastic waterproofing): apply float finish to top of wall prior to final trowel finish.
  - b. Apply trowel finish to horizontal tops of walls. After floating, consolidate concrete surface by final hand-troweling operations, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance no exceeding 3/16-inch in 10-feet, when tested with a 10-foot straightedge.

### 3.14 CONCRETE PROTECTING AND CURING

- A. Cure concrete in accordance with the recommendations of the ACI Manual for Concrete Practice using only moist curing procedures specified in Para. 5.3.6 of ACI 301. Submit proposed curing procedures to Owner's Representative for approval prior to use.
- B. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Where corrosion inhibitor or silica fume admixture have been used, provide continuous water-fog spray or mist or evaporation retardant to prevent plastic shrinkage cracks during initial setting time.
- C. Start curing before concrete has dried and immediately after placing and finishing. Keep concrete moist for at least seven days after casting. Cover with wet burlap and polyethylene and keep well drained while maintaining a damp condition continuously. Fog-spray concrete during the curing period as frequently as drying conditions may require.
- D. Formed Surfaces: Cure formed concrete surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- E. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, and other surfaces.
- F. During curing period, maintain concrete above 70°F for at least two days. Provide heated curing blankets if needed.
- G. Curing Methods: Keep concrete surface continuously wet by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified.
  - 1. Provide moisture curing by any of the following methods at Contractor's option:
    - a. Covering with water.
    - b. Continuous water-fog spray.
    - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
  - 2. Provide moisture-cover curing as follows:
    - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3"

- and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Provide curing compound as follows:
    - a. Apply specified curing compound to exterior and exposed interior concrete slabs as soon as final finishing operations are complete (within 2 hours) and to formed surfaces immediately after forms are removed.
    - b. Apply uniformly in two continuous operations at right angles to each other by powerspray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - c. Use dissipating resin type curing compounds on surfaces which are to be covered with finish or coating material applied directly to concrete, such as liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials. If curing compound is not compatible with coating materials, moisture or moisture-cover curing shall be used.
  - H. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
    1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
    2. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
  - I. Hot weather placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
    1. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
    2. Wet forms thoroughly before placing concrete.
  - J. Keep permanent temperature record showing date and outside temperature for concreting operations. Take thermometer readings at start of work in morning, at noon, and again late in afternoon. Record locations of concrete placed during these periods so any effect temperatures may have had on construction can be correlated. Distribute copies of temperature record daily to Owner's Representative.
  - K. Protect concrete against rapid drying and damage by rain and/or frost. Appearance of plastic shrinkage cracks may be cause for rejection of the concrete and shall be repaired or replaced at Contractor's expense.
  - L. Protect all concrete work against damage and defacement during subsequent construction operations until final acceptance and full cure.
  - M. For patching and filling, comply with ACI 301, Chapter 5, and if premixed repair materials are used, the material manufacturer recommendations.
- 3.15 REMOVAL OF FORMWORK, SHORING AND RESHORING

- A. Contractor shall be responsible for proper removal of formwork shoring, and re-shoring. Comply with
  - 1. ACI 347 for shoring and re-shoring in multi-story construction.
- B. Remove vertical forms as soon as concrete has attained sufficient strength to support its own weight and their removal can be done without damage to the concrete. Apply curing compound immediately after removing forms.
- C. Keep horizontal forms and supports in place for not less than minimum periods of time noted below or until concrete has reached 60 percent of its specified strength.
  - 1. Soffits of beams or girders shall remain in place until concrete has attained 600 day-degrees.
  - 2. Forms of floor slabs shall remain in place until concrete has reached 400 day-degrees.
  - 3. Definition of day-degrees: Total number of days or fractions of days times mean daily air temperature at surfaces of concrete; where concrete surface is protected by insulated blankets or formwork, temperature may be taken under the blankets or formwork. For example, five days at temperature of 60 degrees F. equals 300 day degrees. Days or fractions of days in which temperature is below 50 degrees F. shall not be included in calculation of day-degrees.
- D. When forms are removed, place reshores at same time as stripping operations so that no unshored area is larger than one-fourth of a slab panel. Allow no live load on slab when stripping and shoring are being done.
- E. Field cure test cylinders under same conditions as concrete they represent in order to verify minimum strengths for form removal. Such cylinders and testing shall be at the Contractor's expense.

### 3.16 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
  - 2. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
  - 3. Install joint filler full depth in saw-cut joints and at least 2 in. (50 mm) deep in formed joints.
  - 4. Install compressible filler full depth in expansion joints.

### 3.17 REMOVAL OF FORMWORK, SHORING AND RESHORING

- A. Contractor shall be responsible for proper removal of formwork shoring, and re-shoring. Comply with
  - 1. ACI 347 for shoring and re-shoring in multi-story construction.
- B. Remove vertical forms as soon as concrete has attained sufficient strength to support its own weight and their removal can be done without damage to the concrete. Apply curing compound immediately after removing forms.

- C. Keep horizontal forms and supports in place for not less than minimum periods of time noted below or until concrete has reached 60 percent of its specified strength.
  - 1. Soffits of beams or girders shall remain in place until concrete has attained 600 day-degrees.
  - 2. Forms of floor slabs shall remain in place until concrete has reached 400 day-degrees.
  - 3. Definition of day-degrees: Total number of days or fractions of days times mean daily air temperature at surfaces of concrete; where concrete surface is protected by insulated blankets or formwork, temperature may be taken under the blankets or formwork. For example, five days at temperature of 60 degrees F. equals 300 day degrees. Days or fractions of days in which temperature is below 50 degrees F. shall not be included in calculation of day-degrees.
- D. When forms are removed, place reshores at same time as stripping operations so that no unshored area is larger than one-fourth of a slab panel. Allow no live load on slab when stripping and shoring are being done.
- E. Field cure test cylinders under same conditions as concrete they represent in order to verify minimum strengths for form removal. Such cylinders and testing shall be at the Contractor's expense.

### 3.18 TESTING

- A. Testing and Inspecting: The Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports. Contractor shall provide all required support for testing, including samples of concrete, power for heating/cooling of samples during initial curing, and storage location adjacent to the area of work.
- B. Inspections:
  - 1. Steel reinforcement placement.
  - 2. Steel reinforcement welding.
  - 3. Headed bolts and studs.
  - 4. Chemical anchor system.
  - 5. Verification of use of required design mixture.
  - 6. Concrete placement, including conveying and depositing.
  - 7. Flatness testing.
- C. Curing procedures and maintenance of curing temperature.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:
  - 1. Testing Frequency: Obtain one composite sample for each day's placement of each concrete mixture exceeding 5 cu yd, but less than 25 cu yd, plus one set for each additional 50 cu yd or fraction thereof of each concrete mixture placed each day.
  - 2. Slump: ASTM C143/C143M; one test at point of discharge for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231, pressure method, for normal-weight concrete; one test at point of discharge for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40°F (4.4°C) and below and when 80°F (27°C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C138 whenever air content is measured.
6. Compression Test Specimens:
  - a. ASTM C31; one set of eight standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
  - b. ASTM C39; one set for each day's placement of each concrete mixture exceeding 5 cubic yards, but less than 25 cubic yards, plus one set for each additional 50 cubic yards or fraction thereof of each concrete mixture placed each day.
  - c. Sample plastic concrete for testing in accordance with ASTM C172 and mold cylinders per ASTM C31.
  - d. Cure test specimens for twenty-eight-day-strength verification per ACI 301, Chapter 16.
  - e. Compression Tests:
    - 1) Test three cylinders at seven days.
    - 2) Test three cylinders at twenty-eight days.
    - 3) Hold two cylinders in reserve for use as the Owner's Representative directs.
    - 4) After fifty-six days, unless notified by the Owner's Representative to the contrary, reserve cylinders may be discarded without being tested for specimens meeting twenty-eight-day-strength requirements.
7. Flatness Testing: meeting requirements described in this section.
8. Test results will be reported in writing to the Owner, Owner's Representative, Ready-Mix Producer, and Contractor within 24 hours after tests. Include the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at twenty-eight days, concrete mix proportions and materials, compressive breaking strength, and type of break for both seven-day tests and twenty-eight-day tests.
  - a. If the concrete does not meet the requirements listed above, the concrete shall be rejected, removed, and replaced at the Contractor's expense.
  - b. When strength of field-cured cylinders is less than 85-percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
  - c. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
9. Nondestructive Testing: Rebound hammer, impact-echo, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
10. Additional Tests: The Testing Agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Owner's Representative. The Testing Agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed.

- E. Visual Inspection of Concrete Surface of Newly Placed Concrete:
  - 1. Visually examine the entire exposed new concrete exposed to view surfaces.
- F. Additional testing and inspecting, at the Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- G. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents at no cost to the Owner.
  - 1. Appearance of unconsolidated or honeycombed concrete shall be cause for rejection of the work so affected. Rejected concrete shall be removed and replaced at Contractor's expense.
  - 2. Omission of chamfered edges in formed underside repairs shall be cause for rejection of the work so affected.

### 3.19 ACCEPTANCE AND REPAIRING OF CONCRETE SURFACES

- A. Intent of this Specification is to require forms, mixtures of concrete, and workmanship so that concrete surfaces will require no patching, except for plugging of tie holes.
  - 1. Remove and replace architectural concrete with surface defects exceeding the limitations of ACI 301, Section 13.3.1 or having honeycombs, excessive air voids (bugholes), mismatched coloring, pour lines or sand streaking. The standard of acceptability shall be the surface quality of the approved test panel; or, where no test panel has been made, the standard of unacceptability shall be the photographs shown with paragraphs 7.6 and 7.7 or ACI 309R-96 "Guide for Consolidation of Concrete".
  - 2. Where patching is acceptable to Owner's Representative, procedure shall comply with ACI 301-99, Section 5.3.7 and as described below.
- B. Clean and dampen tie holes and fill solid with patching mortar immediately after form removal. Where plastic plugs have been specified, clean and fill holes in accordance with manufacturer's recommendations.
- C. Do not patch defective concrete and honeycombed areas unless examined and approval is given by Owner's Representative. If the defective concrete is rejected by the Owner's Representative, remove and discard all concrete and replace at no additional cost to the Owner.
- D. If Owner's Representative grants approval to the contractor, areas involved shall be chipped down square and at least one inch deep to sound concrete by means of cold chisels or pneumatic chipping hammers. If honeycomb exists around reinforcement, chip to provide clear space at least three-quarter inch wide all around steel to ensure proper bond thereto. Repairs thicker than one and one-half inches shall be built-up on successive days, each layer of one and one-half inches being applied as described in ACI 301-99, Section 5.3.7. Use specified bonding agent.
- E. Remove and replace patches which become crazed, cracked, or sound hollow upon tapping, at Contractor's expense.

### 3.20 CLEAN-UP

- A. Remove all equipment, unused materials, dirt, rubbish, and debris resulting from the performance of this work. Clean existing surfaces of adjoining work of droppings and where stained by concrete.

END OF SECTION 03 33 01

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Section 04 10 10

SITE STONE

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. Requirements set forth herein are in addition to and shall be considered as complementary to the Terms and Conditions for Construction and the balance of Divisions 00 and 01 and Technical Specifications.
- B. All Contractors, Subcontractors, Vendors and the like shall be required to familiarize themselves with said provisions.

1.2 SUMMARY

- A. The work of this Section consists of providing all labor, equipment, materials and incidental work to selectively furnish and fabricate and completely transport, off-load and stockpile all dimensioned granite pieces and related items as indicated on the Contract Documents, as specified in this Section, and includes, but is not limited to the following items:

- 1. Unit Pavers
- 2. Cheek wall
- 3. Stair Tread
- 4. Stone Curb
- 5. Planter wall

- B. The following sections include work related to this Section:

- 1. Section 012300 Alternates
- 2. Section 024113 Selective Site Demolition
- 3. Section 040125 Masonry Cleaning and Restoration
- 4. Section 042500 Stone Unit Masonry
- 5. Section 055200 Miscellaneous Site Metal Fabrications
- 6. Section 311440 Stone Unit Paving – Mud Set
- 7. Section 321640 Stone Curb
- 8. Section 323000 Site Furnishings
- 9. Section 329300 Planting

1.3 REFERENCES

- A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

- 1. ASTM: American Society for Testing and Materials
  - a. C 97 Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone
  - b. C 99 Standard Test Methods for Modulus of Rupture of Dimension Stone
  - c. C 119 Standard Terminology Relating to Dimension Stone

- d. C 170 Standard Test Method for Compressive Strength of Dimension Stone
  - e. C 241 Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic
  - f. C 615 Standard Specification for Granite Dimension Stone
  - g. C 880 Standard Test Method for Flexural Strength of Dimension Stone
  - h. C1353 Standard Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic
  - i. C1528 Standard Guide for Selection of Dimension Stone for Exterior Use
2. National Building Granite Quarries Association, Inc. (NBGQA): Specifications for Architectural Granite
  3. Building Stone Institute: "Recommended Practices for the use of Natural Stones in Building Construction"

#### 1.4 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings for each piece of stone. Include plans, profiles, sections, anchoring methods, anchors, annotations of stone types, and details as required to completely show materials, layout, jointing, clearances and connections for all items required. Shop Drawings requiring accurate dimensional relationships to as-built construction, shall be prepared following a review and confirmation of as-built measurements and conditions for areas scheduled to receive site improvements. Shop drawings should show all aspects of construction, including but not limited to cut outs, drilled holes, points for anchorage and veneer ties for attaching stone to concrete core, points of attachment for other site furnishings and site improvements specified elsewhere.

1. Coordinate shop drawings with the requirements of applicable Sections of Division 03 Concrete as indicated and specified.
2. Coordinate shop drawings with the requirements of applicable Sections of Division 04 Masonry as indicated and specified.
3. Coordinate shop drawings with the requirements of applicable Sections of Division 05 Metals as indicated and specified.
4. Coordinate shop drawings with the requirements of applicable Sections of Division 07 Thermal and Moisture Protection as indicated and specified.
5. Coordinate shop drawings with the requirements of applicable Sections of Division 26 Electrical as indicated and specified.
6. Coordinate shop drawings with the requirements of applicable Sections of Division 32 Exterior Improvements as indicated and specified.

- B. Material Samples: Samples of the following shall be submitted:

1. Stone: samples shall fully demonstrate color, shade, veining, texture, range, and finish.

<u>Item</u>	<u>Quantity and Size</u>
Unit Pavers	Six (6) Pieces (12-inch x 12-inch x 1.25-inch)
Cheek Wall	One (1) Full size piece 12-inch length
Straight Stair Tread	One (1) Full size piece 12-inch length
Radial Stair Tread	One (1) Full size piece 12-inch length
Stone Curb	One (1) Full size piece 12-inch length
Planter wall	One (1) Full size piece 12-inch length

Stone Types:

Corinthian Granite – thermal finish Six (6) Pieces (12-inch x 12-inch x 1.25-inch)

Woodbury Grey Granite – thermal finish Six (6) Pieces (12-inch x 12-inch x 1.25 inch)

2. Full sized pieces shall be to size, shape and form as shown on the Detailed Drawings. Show finish of exposed-to-view and hidden faces, radius and arriss edges, eased edges at joints.
  3. 12-inch square x 1.25-inch depth pieces shall fully demonstrate color, shade, veining, texture range and finishes of exposed-to-view and hidden faces.
  4. Corinthian Granite stone shall match existing building stone. Contractor shall provide ample time for coordination with local quarries to achieve an acceptable stone match as approved by the Owners Representative.
- C. Constructed Sample: as specified under Section 04 25 00 STONE UNIT MASONRY
- D. Test Reports: Submit reports from tests conforming to ASTM C 67 methods indicating:
1. Compressive strength, psi. (ASTM C 170).
  2. Density, pounds per cubic foot (ASTM C 97).
  3. Absorption by weight, percentage (ASTM C 97).
  4. Abrasion resistance (ASTM C 241).
  5. Flexural strength pounds per square inch, (MPa) (ASTM C 880).
  6. Modulus of rupture, average (pounds per square inch) (ASTM C 99).
- E. Construction Administration Mock-ups. Specified under the following Sections and intended to confirm dimensional coordination with other trades and for approval of workmanship:
1. Section 042500 Stone Unit Masonry
  2. Section 055200 Miscellaneous Site Metal Fabrications
  3. Section 321440 Stone Unit Paving Mud Set
  4. Section 323000 Site Furnishings
  5. Section 329300 Planting – Stone Maintenance Strip
  6. Provide all fabricated stone components specified in those Sections for the specific mockups so identified.

## 1.2 QUALITY STANDARDS

- A. Qualification of manufacturer: A firm experienced in fabricating stone units similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to manufacture required units.
- B. Source Limitations for Stone: Obtain stone units through one source from a single quarry pit for each type of stone specified.
- C. Stone shall be supplied by a source approved by the Owner's Representative.
- D. Stone shall be standard grade, sound and uniform in quality, texture, and strength, and shall free of flaws, cracks, or other defects that may impair its strength, durability, or appearance. Exposed surfaces shall be free from spots, spalls, chips, stains, discoloration, or other defects which would affect its appearance when viewed from a distance of 36 inches as determined by the Owners Representative.

- E. Color, texture, and finish of delivered pieces shall be within the range of samples approved by the Owner's Representative. The Owner's Representative will reject all pieces not conforming to the approved range. Rejection may occur at delivery, after initial inspection after installation, or at final Punch List.

### 1.3 COORDINATION

- A. Obtain all necessary templates and patterns required from other trades for proper execution of work of this Section. Coordinate the delivery of items, templates, and patterns manufactured by other trades to maintain construction schedule. Receive from other trades items to be installed under this Section.
- B. Time the delivery of stone pieces so as to minimize the on-site storage time prior to installation. All stored materials shall be protected from weather, careless handling and vandalism.

## PART 2 - PRODUCTS

### 2.1 GRANITE

- A. Granite shall be sound and uniform in quality, texture, and strength, and shall be free of flaws, reeds, rifts, laminations, cracks, seams, starts, or other defects that may impair its strength, durability, function, or appearance. Exposed surfaces shall be free from spots, spalls, chips, stains, discoloration, or other defects that would affect its appearance.
- B. Granite shall conform to the requirements of ASTM C615 Standard Specification for Granite Dimension Stone. Physical properties shall confirm to C615, Table 1, as follows:

Physical Property	Test Requirements	Test Method(s)
Absorption by weight, max, %	0.4	C97/C97M
Density, min, lb/ft <sup>3</sup> [kg/m <sup>3</sup> ]	160 [2560]	C97/C97M
Compressive strength, min, psi [MPa]	19 000 [131]	C170/C170M
Modulus of rupture, min, psi [MPa]	1500 [10.3]	C99/C99M
Abrasion resistance, min, H <sub>a</sub> <sup>A,B,C</sup>	25	C241/C241M/C1353
Flexural strength, min, psi [MPa]	1200 [8.3]	C880/C880M

<sup>A</sup> Pertains only to stone subject to foot traffic.

<sup>B</sup> The supplier of the No. 60 Alundum abrasive, Norton, has indicated that the formula for Norton treatment 138S has been changed. The new abrasive is currently more aggressive, resulting in lower abrasive hardness values (H<sub>a</sub>) than when the standard was initially established. As such, care should be taken when interpreting H<sub>a</sub> values from tests using the new abrasive, particularly with regard to current ASTM stone standard specification requirements for abrasion resistance, which were developed when the original abrasive was still in use. Committee C18 is actively studying alternatives to address this issue.

<sup>C</sup> Abrasion Resistance Test Method C1353 will eventually replace Test Method C241/C241M and it is not necessary to perform both tests. Availability of the proper equipment and materials by the testing laboratory may determine which test is performed.

- C. Granite types. In accordance with the Construction Documents for granite types for each piece of granite and required finishes.
  - 1. Corinthian Granite – for use on Unit Pavers, Cheek Walls, Planter Wall
  - 2. Woodbury Gray™ Granite – for use on Straight and Radial Granite Stair Treads and Granite Garden Curb
- D. Granite Supplier:
  - 1. Corinthian Granite - Champlain Stone, LTD – 27 Elm Street, P.O. Box 650, Warrensburg, NY 12885, p. (518) 623-2902 or [Info@champlainstone.com](mailto:Info@champlainstone.com)
  - 2. Woodbury Gray™ Granite - Polycor Granite 139 St. Pierre Street, Quebec City (Quebec) Canada G1K 8B9
    - a. Northeast Rep: Igor Zgodic, C:202-870-2120, [Igor.Zgodic@polycor.com](mailto:Igor.Zgodic@polycor.com)

## 2.2 STONE FINISHES

- A. Finish: The product of multiple manufacturers, the stone selected will be subjected to an extensive submittal and inspection process to determine the most suitable finish for each stone in conjunction with each other. In so far as different manufacturers have different finish names, standards and production techniques to produce surface finish and texture, the submittal process may require multiple rounds and requests for alternative finishes. It is the intent of the design process that the stones specified under this Article shall be sawn all sides. Faces and surfaces hidden from view shall remain sawn. Faces and surfaces exposed to view may be fine flame finished, rubbed surfaces, sawn surfaces honed or combination thereof on adjacent faces, depending on the side-by-side comparison of the stones during review. Selection of finish shall add no additional cost to the Owner.
- D. Definition of Stone Finishes:
  - 1. Antique finish: A finish that replicates rusticated or distressed textures. Produced through mechanical or chemical means to simulate the naturally occurring effects of the aging process. Multiple processes similar of those for Water Jet finish to give the appearance of a tumbled or weathered surface. Results and appearance vary according to stone types.
  - 2. Rock (pitch) faced: Similar to split faced, except that the face of the stone is pitched to a given line and plane producing a bold appearance rather than the comparatively straight face obtained in split face.
  - 3. Sandblast Finish - General: A matte-textured surface finish with no gloss, finished by application of a steady flow of sand and water under pressure.
    - a. Sandblast finish, coarse stippled: Coarse plain surface produced by blasting with an abrasive; coarseness varies with type of preparatory finish and grain structure of the granite.
    - b. Sandblast finish, fine stippled: Plain surface, slightly pebbled, with occasional slight “trails” or scratches.
  - 4. Sawn Surface: Relatively plain surface produced by a variety of devices.
    - a. Rough Sawn: A surface finish resulting from the gang sawing process, producing strong parallel scorings.
    - b. Rotary or circular sawn: A surface finish resulting from rotary saw devices that produce circular scorings.

- c. Shot sawn: Plain surfaces with pronounced circular markings, or 'trails' having no regular pattern, with scorings 3/3-inch depth. Specify stainless steel shot or cleaning to remove all ferrous rust stains.
- d. Wire sawing: A method of cutting stone by passing a twisted, multistrand wire over the stone. The wire may either be immersed in a slurry of abrasive material or be fitted with spaced industrial diamond blocks.
5. Split faced: Stone on which the face has been broken to an approximate plane.
6. Thermal (Flamed): The finish produced by application of high-temperature flame to the surface of the stone. Texture shall be non-slip with depth of pitted texture no greater than 2 mm. Large surfaces may have shadow lines caused by overlapping of the torch. This finish will vary in texture and depth between different types of stone as the finish is largely dependent upon the grain structure of the stone. Not recommended for sedimentary stones.

B. Finish shall be per the Contract Documents and approved Shop Drawings

1. Non-exposed-to-view surfaces shall be sawn.
2. All exposed-to-view vertical surfaces shall have the finish as shown the Contract Documents and as selected by the Owner's Representative during the sample review process.
3. Horizontal surfaces for capstones or other pieces that are not walking surfaces shall have the finish selected by the Owner's Representative during the sample review process.
4. Horizontal walking surfaces shall be thermal finish or waterjet finish, including stair treads, tops of flush and raised granite curbs and unit pavers, based on finishes selected by the Owner's Representative during the sample review process.

### 2.3 FABRICATION REQUIREMENTS

A. Fabrication:

1. Size and Dimension: Stone shall be of the sizes and dimensions indicated on the Contract Documents and approved Shop Drawings.
2. Bottom and backs of stone pieces that will be concealed in the finished work shall be sawn to true planes. Sawn pieces of stone shall be cleaned of rust stains and iron particles.
3. Unit pavers:
  - a. Shall have 1/16th inch plus or minus dimensional tolerance for horizontal measurements noted on the Drawings.
  - b. Unit pavers shall be gauged and calibrated to consistent thickness plus or minus 1/6<sup>th</sup>- inch dimensional tolerance.
  - c. Out of Square: plus or minus 1/16<sup>th</sup>-inch difference of diagonals for square pavers.
4. Holes, cut-outs, sinkages and openings in stone work for dowels, pins and anchors shall be accurately cut or drilled to required dimensions, as shown on the approved Shop Drawings, and as necessary to secure stone in place to insure correct location and accurate fit. All such holes shall be located to be hidden-from view in the final condition.
  - a. Allow room for expansion of the anchoring devices where necessary
  - b. Enlarge existing anchor holes in bottom of specified stone pieces to accommodate waterproofing, flashing and thimbles installed under the work of Section 042500 Site Unit Masonry, Section 071413 Hot Fluid-Applied Rubberized-Asphalt Waterproofing, and Section 076200 Sheet Metal Flashing.

- c. Determine increase in hole sizes based on installation mockups as specified in Section 042500 Site Unit Masonry. Coordinate work with Section 040120 Masonry Cleaning and Restoration.
  5. Fabricate stone per requirements, as shown on Drawings, and as follows:
    - a. Stone Fabrication: Comply with NBGQA's "Specifications for Architectural Granite." Except as modified in this Section.
    - b. Fabricate veneer stone pieces to maintain minimum clearance of 1 inch between backs of stone units and surfaces behind stone.
    - c. Arrises: Remove the sharp edge from arrises to slightly blunt edge and to reduce chipping of the finished edge.
    - d. Dress joints straight and at 90 degree angle to face.
    - e. The finish of exposed faces and edges of stone pieces shall comply with requirements indicated for finish and to match final samples and mockups.
    - f. Provide reveals, reglets, openings, and similar features as required to accommodate adjacent work.
    - g. Fabricate molded work, including washes and drips, to produce uniform stone shapes, with precisely formed arrises slightly eased, and matching profile of adjacent units at joints between units.
  6. Lifting clamp dimples, Lewis holes, or other provisions required to accommodate for lifting devices are prohibited on any surfaces intended to be exposed to view. All lifting holes shall be filled with non-shrink group immediately following placement.
- B. Tolerances
  1. Joint Width: Cut stone to produce uniform joints of 1/4 inch plus or minus 1/16th inch
  2. Flatness Tolerance: Variation from true plane, or flat surfaces, shall be determined by use of a 4-foot long straightedge, applied in any direction on the surface. Such variations shall not exceed 1/8 of the specified joint width as variation from true plane.
  3. Stone Fabrication Tolerances:
    - a. Stone thicknesses greater than 2-inches: Plus or minus 1/16th-inch of the nominal thickness.
    - b. Overall face size of veneer stones: Plus or minus 1/16th-inch for height, width and depth dimensions.
    - c. Out of square: Plus or minus 1/16th-inch difference of diagonals.
- C. Inspect finished stone units at fabrication plant. Replace defective units.

### **PART 3 - EXECUTION**

#### **3.1 TRANSPORT, DELIVERY, STORAGE AND HANDLING**

- A. The Contractor shall provide sufficient fabricated pieces of stone to the required sizes to complete the work of the Contract. Locate, procure and delivery stone pieces sufficiently in advance of when they will be installed to meet Project schedules.
- B. Stone shall be carefully packed and banded by the supplier for shipment. Prior to shipping, stone shall be stored on wood skids or pallets, covered with non-staining, waterproof membrane bundles and protected from the weather. Skids shall be placed

and stacked in such a manner as to evenly distribute the weight of the stone and to prevent breakage, cracking, and damage to stone during loading, transport, offloading and stockpiling.

- C. Stone pieces shall be unwrapped and inspected by the contractor upon delivery to the site. Broken or damaged pieces shall become the property of the contractor who shall replace the damaged stones at no additional cost to the Owner. The contractor may forgo inspection upon delivery and assume all responsibility for replacement and maintaining project schedules.
- D. Stone shall be stored in an area of the construction site that is least susceptible to damage from ongoing construction activity. Stone shall be kept in factory wrapped, waterproof bundles on wood skids until the job site is ready to receive for installation. Stone shall not be permitted to be in direct contact with the ground any time during storage.
- E. Once unwrapped stone shall be placed and stacked on wood timbers or platforms at least 2-inches above ground and stacked in such a manner as to evenly distribute the weight of the stone and to prevent breakage, cracking, and damage to individual stones. Stone material shall be stored in such a manner as to allow air to circulate around the stone material. Stone shall not be permitted to be in direct contact with the ground any time during storage.
- F. If storage is to be prolonged, wrap stone in polyethylene sheeting to keep stone dry. Any holes or slots in the stone that are capable of collecting water shall be temporarily covered or plugged to prevent freezing of collected water. Such covers or plugs shall be removed immediately prior to installation of the piece.
- G. Stone shall be carefully handled to prevent chipping, breakage, soiling, or other damage. Pinch or wrecking bars shall not be used without protecting edges of stone with wood or other rigid materials. Stone units shall be lifted with wide-belt type slings wherever possible; wire rope or ropes containing tar or other substances that might cause staining or damage to stone finish shall not be used.
- H. Stone damaged in any manner up until the time of formal written Final Acceptance by the Owner will be rejected and shall be replaced with new materials at no additional cost to the Owner.

### 3.2 NOTIFICATION

- A. Notify the Owner's Representative when stone pieces are scheduled for delivery and schedule his/her attendance on site to witness delivery and stockpiling. The Owner's Representative will inspect the stone pieces for conformance to the requirements of the Contract.

### 3.3 INSTALLATION

- A. In accordance with requirements in:
  - 1. Section 042500 Stone Unit Masonry
  - 2. Section 321440 Stone Unit Paving – Mud Set
  - 3. Section 321640 Stone Curb
  - 4. Section 323000 Site Furnishings



5. Section 329300 Planting

END OF SECTION

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Section 04 25 00  
STONE UNIT MASONRY

**PART 1 - GENERAL**

1.1 GENERAL

- A. Requirements set forth herein are in addition to and shall be considered as complementary to the Terms and Conditions for Construction and the balance of Divisions 00 and 01 and Technical Specifications.
- B. All Contractors, Subcontractors, Vendors and the like shall be required to familiarize themselves with said provisions.

1.2 SUMMARY

- A. The work of this Section consists of providing labor, equipment, materials, incidental work, and construction methods necessary to install stone unit masonry pieces and components, as indicated on the Contract Documents and as specified, including, but not limited to the following items:
  - 1. Cheek walls
  - 2. Stair treads – straight and radial treads
  - 3. Planter wall
- B. The following sections include work related to this Section:
  - 1. Section 024113 Selective Site Demolition.
  - 2. Section 033301 Cast-in-Place Concrete - Site
  - 3. Section 041010 Site Stone
  - 4. Section 055200 Miscellaneous Site Metals Fabrications, for handrails, miscellaneous pins, anchors and plate
  - 5. Section 071413 Hot Fluid-Applied Rubberized-Asphalt Waterproofing
  - 6. Section 076200 Sheet Metal Flashing
  - 7. Section 079000 Joint Sealants
- C. Structural Engineer/Professional Engineer for design of concrete and reinforcing steel, in accordance with the requirements of Division 01 Section SITE CONSTRUCTION PERFORMANCE REQUIREMENTS.
- D. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

1.3 REFERENCES

- A. The following standards shall apply to the work of this Section:

1. National Concrete Masonry Association Standard "Specifications for the Design and Construction of Load Bearing Concrete Masonry." (NCMA)
2. Portland Cement Association "Cold Weather Construction Requirements" (PCA)
3. "Recommended Practices for Cold Weather Masonry Construction" by the International Masonry Industry All-Weather Council.
4. "Specification for Masonry Structures and Commentary (ACI 530.1-08/ASCE 6-081/TMS 602-08, Masonry Standards Joint Committee, comprise the American Concrete Institute, the Structural Engineering Institute of the American Society of Civil Engineers and The Masonry Society.
5. ACI: American Concrete Institute
  - a. 530 Building Code Regulations for Masonry Structures and Specifications for Masonry Structures and Commentaries

B. ASTM: American Society for Testing and Materials

- |         |   |
|---------|---|
| A 82    | Standard Specification for Steel Wire, Plain, for Concrete Reinforcement                            |
| A 153   | Standard Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware                        |
| A193    | Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service                      |
| A 276   | Standard Specification for Stainless Steel Bars and Shapes  |
| C144    | Standard Specification for Aggregate for Mortar Masonry   |
| C150    | Standard Specification for Portland Cement  |
| C207    | Standard Specification for Hydrated lime for Masonry Purposes                                       |
| C270    | Standard Specification for Mortar for Unit Masonry  |
| C 920 S | Specifications for Elastomeric Joint Sealants   |
| C 1193  | Guide for Use of Joint Sealants   |
| D 412   | Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension |
| D 624   | Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers        |

1.4 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings for each item required to be installed under the work of this Section. Include plans, sections, and details as required to completely show materials, layout, jointing, clearances and connections of all items required. Shop drawings for items fabricated and delivered under the work of Section 041010 Site Stone and other site conditions requiring accurate dimensional relations to as-built construction, shall be prepared following a review and confirmation of as-built measurements and conditions for areas schedule to receive site improvements. Items include the following

1. Granite cheekwalls, granite stair treads – straight and radial, granite planter walls, Cast-in-place concrete walls, footings and foundations, showing all aspects of construction, including but not limited to foundations, stem wall, reinforcing and weepage systems.

B. Written procedures for cold weather work:

1. Submit procedure for cold weather work for review and approval by the Owner's Representative.

C. Material Samples: Samples of the following shall be submitted:

1. Mortar. Submit range of colors for Owner's Representative's selection.
  2. Stainless steel pins, joint plates and shim pieces, minimum three pieces of each material.
  3. Through wall flashing
  4. Weeps
  5. Mortar netting
  6. Drainage board.
- D. For Joint Sealants:
1. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each sealant material used. Provide certifications that sealant materials comply with specified requirements.
  2. Initial Selection Samples: Submit samples manufacturer's color charts showing complete range of colors, textures, and finishes available for each material used.
  3. Verification Samples: Submit actual representative samples of each sealant material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide sealant samples having minimum size of 4 inches long.
  4. Test Reports: Provide certified reports for all specified tests.
- E. Constructed Sample:
1. Fabricate and submit a completed 4-foot long minimum, full height, full-width sample section of each cheek wall, planter wall and stairs. Samples shall include all aspects for the walls and stairs, including stem walls, vertical sealed joint, stones and cap stones.
    - a. Upon approval samples shall be the standard of quality for all walls by individual type.
    - b. In the event the sample is not approved, the Contractor shall immediately remove the unapproved sample and submit a new, similarly dimensioned, constructed sample for approval.
    - c. Repeat preparation of samples until acceptance by the Owner's Representative.
    - d. At the Owner's discretion, the sample may serve as part of the finished installation or it shall be removed from the site.
  2. Notify the Owner's Representative and Owner one week in advance of the dates and times when constructed samples will be erected.
  3. Protect constructed samples from the elements with weather-resistant membranes for the duration of the Project.
- F. Manufacturer's Literature: manufacturer's material descriptions and installation instructions for the following:
1. Non-shrink grout material
  2. Mortar bed material
  3. Stainless steel pins
  4. Anchors
  5. Through wall flashing
  6. Weeps
  7. Mortar netting
  8. Joint sealants
-

9. Drainage board

G. Test Reports: Pay for and submit to the Owner's Representative independent laboratory test reports for each type of masonry unit prior to completion of mock-up. Test in accordance with the referenced ASTM specification:

1. Compressive strength	ASTM C216
2. 24-hour cold water absorption	ASTM C216
3. 5-hour boil absorption	ASTM C216
4. Freezing and thawing (50 cycles)	ASTM C216
5. Saturation coefficient	ASTM C216
6. Initial rate of absorption (suction)	ASTM C216
7. Efflorescence	ASTM C216

H. Submit qualifications of the supervising Foreman assigned full time to this Project establishing length of stonework experience and experience in stone site wall installation. Provide letters of reference and a list of completed projects matching the scope of the Work of this Section.

1.5 QUALITY STANDARDS

A. Installer of stone items shall have completed stone installation similar in material and extent to that indicated on the Drawings and in this Section and that has resulted in construction with a record of successful in-service performance.

B. Installer shall have on staff a supervising Foreman assigned full time to this Project, from time of full-scale sample installation until completion of the Work. Foreman shall have at least 10 years total masonry work experience and at least 5 years experience in stone veneer installation of equivalent type and similar scope of this Project.

C. Use numbers of skilled workmen, in addition to required Apprentices, equal to work requirement or occasion. The skilled workmen shall be thoroughly trained and experience in the necessary crafts and shall be completely familiar with the specific requirements and methods needed for performance of the Work of this Section.

D. Joint Sealant

1. Source: For each sealant material type required for the work of this section, provide primary materials that are the product of one manufacturer. Provide secondary or accessory materials that are acceptable to the manufacturers of the primary materials.
2. Installer: A firm with a minimum of 5 years experience in type of work required by this Section.

E. Pre-installation Conference:

1. Schedule a meeting with the masonry installer, a representative of the stone manufacturer, Owner's Representative and the Owner at a time sufficiently in advance of masonry installation to permit coordination.
2. At the meeting review masonry system quality control requirements including details of construction, outstanding submittals, Drawings and Specifications, and on site conditions affecting or which may affect installations.

3. Contractor shall record discussions, including agreements or disagreements on matters of quality control. Furnish copies of recorded discussions to each participant within 3 working days of the meeting.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Stone delivery, storage and handling as specified under Section 041010 Site Stone.
- B. Manufactured items: Deliver all manufactured products in their original containers, plainly marked with product identification and manufacturer's name.
- C. Store metal accessories and the like under cover, away from direct contact with ground, and in a manner to prevent corrosion and accumulation of dirt, grease and oil.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- E. Damaged material: Remove all damaged and contaminated materials from job site immediately, including materials in broken packages and packages bearing water marks or other evidence of damage, unless Owner's Representative specifically authorizes correction and use on the project.

#### 1.7 GENERAL INSTALLATION

- A. Provision and delivery of all fastening devices shall be in accordance with and paid for under this Section.
- B. Free-standing and retaining walls shall be set plumb and horizontal regardless of the pitch of the finished surrounding grade unless otherwise shown on the Contract Documents.
- C. Contractor shall be responsible for the correct location of items of this Section. Take particular care to maintain shapes, plumb and level during the placement of veneers and caps.
- D. All Work shall be accurately set to established lines and elevations and rigidly set in place to supporting construction.

#### 1.8 COORDINATION

- A. The work of this Section shall be completely coordinated with the work of other Sections. Verify dimensions and work of other trades that adjoin materials of this Section before installing items specified.
- B. Obtain all necessary templates and patterns required from other trades for proper execution of work of this Section. Coordinate the delivery of items, templates, and patterns manufactured by other trades to maintain construction schedule. Receive from other trades items to be installed under this Section.

#### 1.9 PROTECTION OF WORK

- A. During stone installation, cover exposed tops of exterior stonework with heavy waterproof sheeting at end of each day's work. Cover partially completed structures when work is

not in progress. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

- B. Staining: Prevent grout, mortar, machine oil, food grease or soil from staining the face of stone to be left exposed. Remove immediately grout, soil or mortar that comes in contact with such masonry. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surfaces.

#### 1.10 COLD AND HOT WEATHER PRECAUTIONS

- A. Follow recommended practices for cold and hot weather masonry construction, in accordance with the standards outlined in the following:
  - 1. PCA "Cold Weather Construction Requirements" (PCA)
  - 2. "Recommended Practices for Cold Weather Masonry Construction" by the International Masonry Industry All-Weather Council.
  - 3. "Specification for Masonry Structures and Commentary (ACI 530.1-08/ASCE 6-081/TMS 602-08)
  - 4. As directed by the Owner's Representative.
- B. Submit procedure for cold weather work for review and approval by the Owner's Representative.

## PART 2 - PRODUCTS

### 2.1 CONCRETE AND REINFORCEMENT

- A. In accordance with the requirements of Division 03 Section CAST-IN-PLACE CONCRETE for steel reinforced concrete footings and foundations for spread footings and stem walls to receive stone veneer and stone capstones.
- B. In accordance with the requirements of Division 01 Section SITE CONSTRUCTION PERFORMANCE REQUIREMENTS, provide the services of a Structural Engineer/Professional Engineer licensed in the Commonwealth of Massachusetts to develop calculations and sizing for reinforcing steel and concrete for spread footings and stem walls to receive stone veneer and stone capstones.

### 2.2 STONE

- A. Stone delivered, offloaded and stockpiled in accordance with Section 041010 SITE STONE.

### 2.3 MISCELLANEOUS ACCESSORIES

- A. Skateboard deterrents as specified in Division 32 Section SITE FURNISHINGS.
- B. Pins, joint plates and shims:
  - 1. Stainless steel pins shall be stainless steel bar stock conforming to the requirements of ASTM A276-98B Type 316, sized as shown on the Drawings.



- C. Masonry Anchors:
  - 1. Stainless steel shall be Type 304 austenitic stainless steel per ASTM A167 and A193, #433 Stone Anchor by Hohmann & Bernard, Inc, or approved equal.
- D. Weeps: Provide ultraviolet resistant honeycomb polypropylene weep cell vents, matching color of mortar.
  - 1. Dur-O-Wal, Inc., product "Cell Vent",
  - 2. Hohmann & Barnard, Inc., Model GV "Quadro-Vent",
  - 3. Heckman Building Products; product "#85, Cell Vent".
  - 4. Wire-bond, Model 3601 "Cell Vent".
- E. Mortar netting: High Density Polyethylene (HDPE) course geotextile fabric having a 90 percent open weave mesh, with stepped topped edging, shaped in a manner to catch and hold mortar droppings and preventing blockage of weep hole vents, nominal 1 inch thick by 5 feet long by 10 inches high.
  - 1. Hohmann & Barnard, Inc. product "Mortar Net".
  - 2. Mortar Net USA, Ltd., Highland IN., product "Mortar Net".
  - 3. Wire-bond, Inc., Charlotte, NC, product "Mortar Net Green".
- F. Cleaning solution: Non-acidic, not harmful to masonry work or adjacent materials.

#### 2.4 GROUT

- A. Grout for embed stainless steel items shall be a non-staining, non-shrink cement grout conforming to ASTM C-827. Grout shall contain no metals. Grout shall be one of the following or an approved equal:
  - 1. Five Star Grout, U.S. Grout Corporation
  - 2. Sika Grout 212, Sika Corporation
  - 3. Harris Construction Grout, A.H. Harris & Sons Inc.

#### 2.5 MORTAR MATERIALS

- A. Setting bed mortar shall conform to ASTM C 270, Type M, except that latex polymer additive shall be mixed with the cementitious materials and aggregate in lieu of water.
- B. Cement: Shall be an American Portland cement conforming to ASTM C150, Type I or II, except Type III may be used for cold-weather construction, as selected by the Owner's Representative and shall exhibit no efflorescence when cast into 2 inch x 7 inch x ½ inch slabs comprising the mortar under test.
- C. Water: clean, fresh and potable, from public water system.
- D. Sand: clean, washed, uniformly well-graded, conforming to ASTM C144 with 100 percent passing No. 8 sieve, and not more than 35 percent passing No. 50 sieve with a fineness modulus maintained at 2.25 plus or minus 0.10.
  - 1. White-Mortar Aggregates: Natural, white sand or ground, white stone.

2. Colored-Mortar Aggregates: Natural, colored sand or ground marble, stone, or other sound stone; as required to match Architect's sample.
- E. Hydrated Lime: provide plastic hydrate, conforming to ASTM C207, Type "S" as approved by the Owner's Representative.
- F. Integral waterproofing: for all mortar use Master Builder's "Omicron Mortar-proofing", Sonneborn "Hydrocide", Pardee "Drycrete", or equal.
- G. Mortar Pigments: shall be pure, non-fading mineral pigmented mortar cement equal to Medusa, Flamingo or Hydroment as approved by the Owner's Representative. Use only pigments with record of satisfactory performance in masonry mortars. Color materials shall not exceed 2 percent of weight of cement used. Color shall be as selected by the Owner's Representative.
- H. Anti-freeze admixtures and accelerators shall not be used in mortar.

## 2.6 FLASHING

- A. Thru-wall flashing shall be a surface mounted flashing, 40-mil thickness composite membrane with adhesive backing. Membrane shall be polyethylene sheet made from minimum 45% recycled material. Membrane adhesive shall be factory-laminated with removable release paper. Provide compatible primers and accessories.
  1. Textroflash Flashing by Hohmann & Barnard or approved equal.

## 2.7 JOINT SEALANTS

- A. Self-leveling Polyurethane Sealant
  1. Provide two or more part, self-leveling, polyurethane based elastomeric sealant, complying with ASTM C 920, Type 1 Class A, having Shore A hardness of not less than 30 when tested according to ASTM C 920, cured modulus of elasticity 100 percent elongation of not more than 150 psi, when tested according to ASTM D 412, and tear resistance of not less than 50 pounds per inch when tested according to ASTM D 624.
  2. Where joint surfaces contain bituminous materials, provide modified sealants that are compatible with bituminous materials encountered.
  3. Provide one of the following products that meet or exceed specified requirements:
    - a. Pecora Urexpan NR-200.
    - b. Mameco Vulkem 245 or 255.
    - c. Sika 2C, SL.
    - d. Sonneborn Sonolastic PvJtSt.
    - e. Tremco THC 900.
  4. Extent: Provide self-leveling polyurethane sealant for concrete-to-concrete paving joints, stone-to-stone paving expansion joints, and for all horizontal stone-to-stone joints between pieces of Site Stone.
- B. Non-sag Polyurethane Sealant
  1. Provide multi-part, non-sag, polyurethane based elastomeric sealant, complying with ASTM C 920 Type M, Grade NS, Class 25, having Shore A hardness of 20 to 30, cured modulus of elasticity at 100 percent elongation of not more than 75 psi,

and tear resistance of not less than 50 pounds per inch when tested according to ASTM D 624.

2. Provide one of the following products that meet or exceed specified requirements:
  - a. Mameco International Vulkem 227.
  - b. Harry S. Peterson Co. Iso-Flex 2000.
  - c. Sika Sikaflex 2c NS.
  - d. Sonneborn Sonolastic NP 2.
  - e. Tremco Dymeric.
3. Extent: Provide non-sag polyurethane sealant for all vertical concrete-to-concrete joints, stone-to-stone joints and stone-to-concrete joints, and other joints not indicated to be sealed with another type of sealant.

C. Miscellaneous Joint Materials

1. Primer: Provide primer recommended by sealant manufacturer for surfaces to be adhered to.
2. Bond Breaker Tape: Provide polyethylene or other plastic tape recommended by sealant manufacturer to prevent three-sided adhesion.
3. Backer Rod: Provide compressible rod of durable non-absorptive material recommended by sealant manufacturer for compatibility with sealant. Provide products of one of the following manufacturers:
  - a. Backer Rod Manufacturing and Supply Co.
  - b. Dow Chemical Co.
  - c. W. R. Meadows, Inc.
  - d. Williams Products, Inc.
  - e. Woodmont Products, Inc.
4. Joint backing for general use at joints in horizontal and vertical surfaces shall consist of two rows of butyl rubber or neoprene foam rod in contact with one another, and each compressed to approximately 2/3 original width when in place.
5. Provide miscellaneous materials of type that will not bleed through sealant, discolor surface, or produce other deleterious effects. Select size to provide compression to approximately 2/3 original width when in place. Provide backing material profile concave to the rear of the sealant, and equipped with a bond-breaking film.

2.8 DRAINAGE BOARD

- A. J-Drain 700 Prefabricated Drainage Composite, fully wrapped and encased all sides with woven filter fabric. Cut, bend and shape to accommodate installation requirements and the configuration demands of the site installations.
- B. J-Drain SWD-12 with fittings and accessories, including end caps, outlets, splices, corners, step downs and t-connectors as appropriate to accommodate installation requirements and the configuration demands of the site installation.
- C. Manufacturer: JDR Enterprises, Inc., Alpharetta, GA; [www.j-drain.com](http://www.j-drain.com)
- D. Contractor shall select and provide all fittings, accessories and appurtenances necessary for complete installation, including connections to storm drain utilities so specified in applicable Division 33 Sections and as directed by the Owner's Representative.

**PART 3 - EXECUTION**

- 3.1 CAST-IN-PLACE CONCRETE: installed in accordance with Division 03 requirements.
- 3.2 EXAMINATION - GENERAL
- A. Verify that field conditions are acceptable and are ready to receive unit masonry work.
  - B. Verify built-in and other items provided by separate Sections of the work are properly sized and located.
  - C. Verify field measurements are as shown on shop drawings.
  - D. Beginning of installation means acceptance of field conditions.
- 3.3 INSTALLATION OF DRAINAGE BOARD SYSTEMS
- A. Coordinate the installation of J-Drain 700 and J-Drain SWD-12, fittings, accessories and appurtenances with applicable requirements of Division 03 Sections for cast-in-place concrete, Division 31 Sections for earth moving, Division 32 Sections for concrete pavement and Division 32 Sections governing installation of curb, furniture and unit paving.
  - B. Install J-Drain 700 and J-Drain SWD-12 and all fittings, accessories and appurtenances in accordance with the construction drawings, details and cross sections and as directed by the Owner's Representative. Install in sequence to insure full coordination with site earthwork, storm drain installation, placement of concrete pavement and base slabs for unit paving, stair treads and the requirements of this Section.
  - C. Install J-Drain 700 and J-Drain SWD-12 and all fittings, accessories and appurtenances in accordance with manufacturer's written instructions and product literature.
- 3.4 PREPARATION FOR INSTALLING CAP STONES
- A. Advise installers of other work about specific requirements relating to placement of inserts, flashing, piping, channels, reglets, stainless steel anchor pins and similar items which will be used by stonework Installer for anchoring and supporting stonework. Furnish installers of other work with drawings or templates showing locations of these items. Coordinate with the work of other trades relative to drawings to locate weld-plates and embeds for connection of stone skin or its system.
  - B. Protect surrounding work from damage or disfiguration, by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.
  - C. Establish lines, levels, and coursing. Protect from disturbance.
  - D. Direct and coordinate placement of metal anchors supplied to other Sections.
  - E. Provide temporary bracing during installation of stone veneer. Maintain in place until pieces are fully anchored.
  - F. Scaffolding: Where required for safety and access. Provide, erect, maintain, move, and finally remove scaffolding and staging required for masonry installation. Construct and maintain scaffolding in compliance with applicable ordinances, laws, rules and

regulations. Scaffolding shall be sufficiently substantial to support workmen, and necessary materials and equipment. Provide adequate guard rails for protection of property, workmen, and passerby.

- G. Clean all stone pieces prior to erection. Do not use wire brushes or implements that will mark or damage exposed surfaces.

### 3.5 MORTAR BEDDING

- A. Set stone and capstones on concrete footing in full bed of mortar with all vertical joints slushed full.
- B. Install all stone complete and in place with specified stainless steel anchor pins in accordance with the detail drawings and as directed by the Owner's Representative. Coordinate with requirements for installation of grout so specified in this Section.
- C. Apply enough mortar at bed and end joints to allow mortar to be forced out both sides of the face shell. Wet stone joint surfaces thoroughly before setting. For stone surfaces that are soiled, clean bedding and exposed surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
- D. Fully bond intersections, and external and internal corners as shown on the Detailed Drawings.
- E. Install specified weeps and netting in base courses of stone veneer walls. Provide mortar back up as required. Set weeps in base stones at grades as required by field conditions.
- F. Do not shift, or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.
- G. Remove excess mortar on surface and in cavities.
- H. Perform job site saw cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.

### 3.6 MORTAR PROPORTIONING AND MIXING

- A. Except as otherwise specified in this Section, conform to the property and proportion requirements of ASTM C270 for all mortar.
- B. Mixing: Mortars shall be machine-mixed in an approved type of mixer in which the quantity of water can be accurately and uniformly controlled. Where hydrated limes are used for mortars requiring a lime content, the materials for each batch shall be well-raked and turned over together before the water is added until the even color of the mixed materials indicates that the cement materials have been thoroughly distributed throughout the mass, after which the water shall be gradually added until a thoroughly mixed mortar of the required plasticity is obtained. The same mortar mixture shall be used for all similar work.
- C. The color of mortar shall be strictly controlled to assure uniformity of color through the work.

- D. The method of measuring materials shall be such that the specified proportions of the materials can be controlled and accurately maintained. Shovel measurement will not be allowed.
- E. All cement materials and aggregates shall be mixed at least 3 minutes in the mixer with the minimum amount of water required to produce a workable consistency. Hand mixing shall not be used unless specifically approved.
- F. Mortar that has begun to set or which is not used within 2-1/2 hours after initial mixing shall be discarded. Mortar that has stiffened due to evaporation within the 2-1/2 hour period shall be re-tempered to restore its workability. Re-tempering mortar that has partially hardened without additional cement aggregate or water, will not be permitted.
- G. Mortar boxes and all tools shall be thoroughly cleaned at the end of each day's work, and between batches.

### 3.7 GROUTING EMBEDDED ITEMS

- A. Grout metal items embedded or built into stone work solidly with grout.
- B. Grout around sleeves, pipes, and all other items that pass-through walls solidly with mortar materials. Place grouting to be air tight and to prevent air leakage.
- C. Grout stainless steel anchor pins fully into place to anchor stone to concrete, placing grouting air tight and to prevent air and water leakage and penetration.
- D. Grout skateboard deterrents fully into place to locations shown and as directed. Coordinate with the applicable requirements of Division 12 Section SITE FURNISHINGS.

### 3.8 STONE WALLS – GENERAL WORKMANSHIP

- A. Exact alignment of walls shall be staked by the Contractor and approved by the Owner's Representative prior to commencement of stone wall work.
- B. Clean stone before setting by scrubbing with fiber brushes followed by a thorough drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh fillers or abrasives.
- C. Set stone in accordance with and to the elevations noted on the Drawings and approved final Shop Drawings. Provide fasteners and other attachments shown, specified or necessary to secure stone work in place in accordance with the best practices of the trade. Shim and adjust accessories as required for proper setting of stone. Completely fill holes, slots and other sinkages for anchors, dowels, fasteners, and supports with non-shrinking, non-staining mortar during setting of stone.
- D. Erect all stone work in compliance with line and level tolerances specified in this Section. Correct or replace, as directed by the Owner's Representative, non-conforming stone work at no additional cost to the Owner.
- E. Lay no exposed stone having chipped edges or face defects. Remove any such piece, if installed, and replace with undamaged stone, and bear all costs of this Work.

- F. Examine all Contract Documents as to requirements for the accommodation of work of other trades and Contractors. Take every precaution to minimize cutting and patching. Deliver inserts and other anchorage items required to be cast into concrete in sufficient time to prevent any delay in such work. Closely coordinate the location and placement of such items.
- G. Provide protection against breakage and weather damage to all stone work, including coverings over the tops of walls and wherever necessary to protect work at all stages of completion. Protect stone at all times when masons are not working on the walls. Apply tarpaulins or waterproof paper properly weighted or nailed to assure their remaining in place to protect masonry.
- H. Take special care to avoid soiling or staining stone that is to remain exposed in finish work. Do not allow any petroleum-based fillers or sealants to come into contact with stone work.

### 3.9 REINFORCEMENT AND ANCHORAGES

- A. Attach wall ties to concrete surfaces for veneer construction to insure no less than 8 anchor connects per stone for vertical and two anchor connections per stone for capstones.
- B. Anchorage:
  - 1. Install stainless steel anchors to prevent stones from moving in any direction, including forward away from the concrete core wall, inward toward the concrete wall and laterally toward adjacent veneer stones.
  - 2. Install stainless steel anchor pins to prevent stones from moving in any direction.

### 3.10 WEEPS AND VENTS

- A. Install weep holes in veneer in locations shown on the Contract Documents.
- B. Weep holes and mortar netting at Veneer Walls:
  - 1. In accordance herein and as follows:
  - 2. Installation of netting and weeps shall be accordance with manufacturer's recommendations, as directed by the Owner's Representative and as noted herein.
  - 3. Install rainscreens and weeps in stone veneer base courses in locations as directed but no less than every third vertical joint for veneer walls. Set bottom of weeps as shown. Contractor to note the base course stone veneer pieces are set below adjacent pavement grades.
  - 4. Install weeps, netting and latex modified mortar backing as an integrated system. Before proceeding with installation of successive courses of stone veneer, demonstrate to the Owner's Representative the netting and weep system drains quickly and effectively. Test weep holes with a 5 gallon pour of water to demonstrate all weep holes drain without clogging and with water backing up behind the veneer system.

### 3.11 TOLERANCES FOR INSTALLATION OF STONE

- A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.

- B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum.
- C. Cross Slope of Wall Caps: Slope the top of walls 1/8 inch per foot as shown on the Contract Documents.
- D. Variation in Plane between Adjacent Surfaces (Lipping): Do not exceed 1/16-inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

### 3.12 JOINT SEALANT

- A. Inspection
  - 1. The Installer shall examine substrates and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning of sealant work means Installer's acceptance of joint surfaces and conditions.
- B. Preparation
  - 1. Strictly comply with manufacturers' instructions and recommendations, except where more restrictive requirements are specified in this Section.
  - 2. Clean joint surfaces immediately before installation of sealants, primers, tapes and fillers. Remove substances that could interfere with bond. Etch or roughen joint surfaces to improve bond. Surfaces which have been given protective coatings and those that contain oil or grease shall be thoroughly cleaned with xylol or MEK solvent, with due precautions taken to minimize hazards.
  - 3. Unless otherwise indicated, use of sealants shall conform to ASTM C 1193.
  - 4. Tape or mask adjoining surfaces to prevent spillage and migration problems.
  - 5. Prime surfaces as recommended by sealant manufacturer.
- C. Installation
  - 1. Provide backer rods for joint sealants except where specifically recommended against by sealant manufacturers.
  - 2. Prevent three-sided adhesion by use of bond breaker tapes or backer rods.
  - 3. Force sealant into joints to provide uniform, dense, continuous ribbons free from gaps and air pockets. Completely wet both joint surfaces equally on opposite sides.
  - 4. Except in hot weather, make sealant surface slightly concave. Install sealants so that compressed sealants do not protrude from joints. Dry tool sealants to form a smooth dense surface. At horizontal joints form a slight cove to prevent trapping water.
  - 5. Provide sealants to depths indicated, or if not indicated, follow manufacturer's recommendations.
- D. Extent of Sealant Work
  - 1. General Extent: Seal joints indicated, and all exterior joints, seams, and intersections between dissimilar materials. Provide elastomeric sealant installation with backer rod in all exterior expansion joints.



2. Exterior Sealing: Without limitation, the work of this Section includes sealing the following:
  - a. Concrete-to-concrete joints, both horizontal and vertical.
  - b. Stone-to-stone joints, both horizontal and vertical.
  - c. Miscellaneous joints shown on the drawings and details.

E. Curing

1. Cure sealants in strict compliance with manufacturers' instructions and recommendations to obtain highest quality surface and maximum adhesion. Make every effort to minimize accelerated aging effects and increase in modulus of elasticity.

F. Cleaning and Protection

1. Remove smears from adjacent surfaces immediately, as the work progresses. Exercise particular care to prevent smearing or staining of surrounding surfaces which will be exposed in the finished work, and repair any damage done to same as result of this work without additional cost to Owner.
2. Clean adjacent surfaces using materials and methods recommended by sealant manufacturer. Where required, high-pressure washing or the use of chemical cleaners shall be employed to clean adjacent surfaces.
3. Remove and replace work that cannot be successfully cleaned or work that is damaged or deteriorated.

3.13 CLEANING OF WORK

- A. During the progress of the Work, keep the exposed surfaces of stone clean at all times and protected against damage.
- B. Prior to final cleaning work, examine all faces of walls to locate cracks, holes or other defects. Remove and replace any joint work that cannot be successfully cleaned or repaired. Remove and replace stone that are chipped, broken, stained, or otherwise damaged.
- C. Provide polyethylene coverings or other temporary protection approved by the Owner's Representative for all planting and other non-working areas or improvements adjacent to stone cleaning zone. Plant beds shall be further protected from foot traffic and the associated soil compaction by the placement of planking wherever foot traffic is anticipated. Remove protective coverings from planting areas immediately following completion of cleaning operations.
- D. Final Cleaning: After joints are thoroughly set and cured and before Final Completion at a time approved by the Owner's Representative, clean exposed wall faces as follows:
  1. Remove excess mortar or joint sealer particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  2. Submit proposed cleaning procedures and cleaning materials to the Owner's Representative for approval before commencing work. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain the Owner's Representative approval of sample cleaning before proceeding with cleaning of masonry. General cleaning shall not commence until the Owner's Representative has approved the test area.

3. Protect adjacent stone and moonstone surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
  4. All cleaning operations shall proceed from the top down.
- E. Final cleaning work shall be performed only when atmospheric temperature is above 40 degrees Fahrenheit and rising.
1. Use of wire brushes or other abrasive tools for cleaning will not be permitted.
  2. Provide suitable protective coverings for all other surfaces and materials during the final cleaning procedures and bear full responsibility for correcting any damaged caused by these operations, to the satisfaction of the Owner's Representative.
  3. Remove from the site and legally dispose of all cartons, rubbish and debris resulting from work under this Section not less often than once per week.

#### 3.14 PROTECTION

- A. Maintain protective boards at exposed external corners which may be damaged by construction activities.
- B. Provide protection without damaging completed work.
- C. Keep expansion joint voids clear of mortar.

END OF SECTION

Section 04 92 00  
STONE MASONRY RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Description of existing assemblies: Stone materials indicated to remain and to be selectively restored are present at the exterior faces of the building, including areas above the roof, as indicated on drawings and further described below.
1. Existing buildings are constructed of load-bearing stone masonry walls. Exterior walls are typically 1'-6" thick. The face stone is laid in a random-coursed ashlar pattern. Dressed stone trim exists at copings, chimneys and window surrounds.
    - a. Existing stone materials:
      - 1) "Llenroc" siltstone (typical facing stone, including chimneys).
      - 2) Limestone (trim).
  2. Existing conditions to be addressed in the work include joint weathering, broken units, cracked units, displaced units, soiling, and presence of inappropriate pointing materials, ferrous elements or plant material.
- B. Scope of Work:
1. Field-verification of conditions and dimensions of existing stone masonry assemblies.
  2. Protection of existing masonry surfaces indicated to remain without either repair or cleaning surrounding areas where repair or cleaning work is indicated.
  3. Plywood protection panels at existing windows, to protect windows indicated to remain from damage arising from work of this Section and other exterior work.
  4. Selective demolition of masonry assemblies as indicated.
  5. Dismantling, removal, storage and protection of existing stone, for installation at new locations as indicated.
  6. Removal and protection of existing stone, for delivery to Owner's storage location.
  7. Stone restoration work indicated on the drawings according to the key below. Execution requirements for each item is indicated in Part 3 of this Section.
    - a. ST1 - Area Rebuild
    - b. ST2A - Area Repointing Mortar
    - c. ST2B - Area Repointing sealant
    - d. ST2C - Lead Weathercaps

- e. ST2D - Deep Repointing Mortar
  - f. ST3 - Stone Patch Repair
  - g. ST4 - Stone Dutchman Repair
  - h. ST5 - Ferrous Element Removal
  - i. ST6 - Non-structural Crack Repair
  - j. ST7 - Structural Crack Repair
  - k. ST8 - Loose Material Removal
  - l. ST10 - Stucco Repair
  - m. ST11 – Stone Replacement
8. Selective local masonry cleaning where indicated to be part of the work of keyed stone restoration, in Part 3 of this section. Masonry cleaning is included only in association with local repairs, and not as a general cleaning program for the building exterior.
9. Work indicated in this Section, by extension of the numbered types of work indicated above, as follows below. Quantities or percentages indicated are part of the contract work and are not subject to unit pricing or allowances. The intent of this paragraph is to quantify contract work not easily represented on drawings or whose location cannot be known before commencement of the work.
- a. ST-1 AREA REBUILD: Additional (144) square feet of rebuilt stone masonry.
  - b. ST-2 AREA REPOINTING MORTAR: Additional (120) lineal feet of joint repointing.
  - c. ST-3 STONE PATCH REPAIR: Additional (144) square inches of patch repair, distributed locations.
  - d. ST-4 STONE DUTCHMAN REPAIR: Additional (96) square inches of dutchman repair, distributed locations. 0
  - e. ST-6 NON-STRUCTURAL CRACK REPAIR: Additional (36) lineal feet of crack.
  - f. ST-7 STRUCTURAL CRACK REPAIR: Additional (18) lineal feet of crack.
  - g. ST-8 LOOSE MATERIAL REMOVAL: Additional (256) square inches feet of removal.
  - h. ST-10 STUCCO REPAIR: Additional (12) square feet of repair, including also removal and replacement of ten units of brick masonry backup if not sound.
  - i. ST-11 STONE REPLACEMENT: Additional (12) units.
10. Removal of existing unused anchors, hardware and similar items at exterior stone surfaces.

11. Reuse of existing reglets in existing stone elements for new flashing or waterproofing, as indicated on drawings.
  12. Repair, patching or replacement of stone masonry units and mortar as indicated on the drawings.
  13. Protection of existing masonry surfaces indicated to remain surrounding areas where repair work is indicated.
  14. Removal of plants, at areas where repair work is indicated.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
1. Unit Prices in Division 1 Section "Unit Prices"
  2. Requirements related to hazardous building materials including but not limited to asbestos are indicated in Division 02 Section ASBESTOS ABATEMENT.
  3. Concrete masonry unit work is indicated in Division 02 Section UNIT MASONRY.

## 1.2 DEFINITIONS

- A. Stone terminology: ASTM C 119.
- B. Very Low-Pressure Spray: Under 100 psi (690 kPa)
- C. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.
- D. Joints between stone and other materials: These joints shall be classified as stone joints and are subject to requirements of this section.
- E. Scope of work terms: Words used on drawings and in specification shall have meanings as indicated below:
  1. Remove: Detach item or assembly from existing construction and legally dispose of off-site, unless indicated to be removed and salvaged or removed and reinstalled.
  2. Remove and Salvage: Carefully detach item or assembly from existing construction, in a manner to prevent damage, and deliver to Owner.
  3. Remove and Reinstall: Carefully detach item from existing construction, in a manner to prevent damage, prepare for re-use, and reinstall where indicated.
  4. Remove and Protect Openings: Detach item or assembly from existing construction and legally dispose of off-site unless indicated to be removed or salvaged or removed and reinstalled. Provide temporary weather-tight closure of

opening. Final installation of permanent materials will be in future construction by others.

5. Remove and Replace: Detach item or assembly from existing construction in a manner to prevent damage and replace with new to match existing material, profiles and appearance.
6. Existing to Remain: Existing items or assemblies of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
7. Restore: Retain existing material to maximum extent possible. Repair element to its original appearance using traditional materials and workmanship.

### 1.3 SUBMITTALS

- A. Stone Field Survey (Repairs to Existing): Prior to commencement of restoration work at stone masonry, the Contractor shall complete a thorough survey of the existing conditions to confirm the Contract Document Scope. The Contractor shall inform the Architect of any deviations from the scope of work as shown on the contract documents.
  1. After scaffolding is in place and access to an elevation, or portion of an elevation, is available, the Contractor shall review the existing conditions of the façade on a unit by unit basis to confirm the scope of work as shown on the drawings.
  2. Inspection work shall include full visual inspection and sounding of all existing dutchman repairs and patching materials, and any areas of new deterioration that is discovered during the visual inspection.
  3. The Contractor shall document, on a reproducible set of elevations furnished by the Architect, deviations from the scope shown on the drawings and submit them for review by the Architect. The survey notation and intent of repairs must be the same as those used in the original drawings.
  4. The submittal must be reviewed for direction prior to proceeding with final Work in any location
  5. During the progress of the survey work provide access for the Architect's review of the quantity and quality of work.
- B. Preconstruction Documentation Photographs: Document existing conditions prior to commencement of work. Submit photographs of work to be dismantled and reinstalled as listed below. Provide sufficient photographic views to describe all portions of the work, all masonry to be dismantled shall be clearly shown. Key photographs with shop drawings. Photographs shall be reviewed and approved by Architect prior to commencing with dismantling work.
  1. Prints: Provide digital images, minimum 300 dpi, jpgs. Label each image with the following information:
    - a. Project identification.
    - b. Orientation of view.
    - c. Identification number correlating with shop drawings.
    - d. Date and time image was taken

- C. Stone Documentation (Dismantling): Submit written method of disassembly and shop drawing(s) of stone identification prior to actual stone disassembly.
1. Record all stone dimensions and locations on shop drawings. Documentation shall occur for all materials to be removed. Include documentation for modifications to the backs of individual stones.
  2. Documentation method must be approved by the Architect prior to commencing removal of any material.
  3. All elements shall be numbered and photographed before removal and tracked throughout the removal and rebuilding process to ensure that all elements are installed in their original locations.
  4. Submit shoring requirements with stone documentation for surrounding assemblies where necessary.
- D. Restoration Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of restoration work including protection of surrounding materials and Project site.
1. Include methods for keeping pointing mortar damp during curing period.
  2. If materials and methods other than those indicated are proposed for any phase of restoration work, add to the Quality-Control Program a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project and worker's ability to use such materials and methods properly.
  3. For repair of structural cracks and where stones are required to be attached to separate stone or brick backup, the contractor shall provide engineering services of a professional engineer licensed in the State of New York, who shall structurally design all such connections. Submit shop drawings and calculations for these connections. The contractor's engineer shall be responsible for verifying the size, spacing, and related details of the new anchors and other supports to properly support and brace the attached stones
- E. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage due to worker fatigue.
- F. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.
- G. Samples for Initial Selection: For the following:
1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches (150 mm) long by 1/2 inch (13 mm) wide, set in aluminum or plastic channels.
    - a. Have each set contain a close color range of at least six Samples of different mixes of colored sands and cements that produce a mortar matching the original mortar when cured and dry.
    - b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each Sample was made.

2. Patching Compound: Submit sets of patching compound Samples in the form of plugs (patches in drilled holes) in sample units of stone representative of the range of stone colors on the building. Have each set contain a close color range of at least six samples of different mixes of patching compound that matches the variations in existing stone when cured and dry.
  3. Sealant Materials: See Division 7 Section "Joint Sealants."
  4. Include similar Samples of accessories involving color selection.
- H. Samples for Verification: For the following:
1. Each type of sand used for pointing mortar; minimum 1 lb (0.5 kg) of each in plastic screw-top jars.
    - a. For blended sands, provide Samples of each component and blend.
    - b. Identify sources, both supplier and quarry, of each type of sand.
  2. Each type, color, and texture of pointing mortar in the form of sample mortar strips, 6 inches (150 mm) long by 1/2 inch (12 mm) wide, set in aluminum or plastic channels.
    - a. Include with each Sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry, of each type of sand and brand names of cementitious materials and pigments if any.
- I. Material Certificates: Certificates of compliance stating that the materials meet the specified requirements for:
1. Epoxy and mortar patching materials.
  2. Mortar Coloring.
  3. Mortar Admixtures.
- J. Submit the following under provisions of Section 01 33 00 - Submittal Procedures:
1. LEED Submittal Requirements:
    - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
      - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
        - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
        - b) EPD shall have at least Cradle to Gate scope,
      - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
    - b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
      - 3) Recycled Content:
        - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO



- 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
- b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
- 4) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
- a) Documentation should be in the form of one of the following:
  - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
  - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
  - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
  - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
  - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
- 5) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an HPD.

#### 1.4 QUALITY ASSURANCE

##### A. Pre-Construction Testing of Existing Stone Mortar:

1. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on existing mortar as follows:
  - a. Provide test specimens as indicated and representative of proposed materials and construction.
  - b. Existing Mortar: Test according to ASTM C 1324, modified as agreed by testing service and Architect for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength. Use X-ray diffraction, infrared spectroscopy, and differential thermal analysis as necessary to supplement microscopical methods. Carefully remove existing mortar from within joints at five locations designated by Architect.
    - 1) Provide separate tests for mortar as scheduled below, three of each type:
      - a) Between two limestone units, and
      - b) Between a Llenroc unit and a limestone unit.
    - 2) Testing of mortar between two Llenroc units is not required.
    - 3) Prior to selection and removal of any existing mortar for laboratory analysis, physical investigation will be required to determine depth of original mortar (i.e., subsequent mortar repairs and/or replacements may have occurred over original mortar). Suitable mortar locations for

testing of original building mortar and potential depth requirements to uncover original mortar beds will be identified as part of the physical investigation.

- B. Masonry Restoration Contractor Qualifications: Engage an experienced masonry restoration firm, with a minimum of seven (7) years of documented experience in historic preservation projects. Work shall be done by skilled workmen, fully instructed as to the requirements Specified herein and adequately supervised during the work. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance in the past five (5) years. Previous projects should be listed on either the National or State Register of Historic Places, or be comparably designated at the city or town level.
1. Masonry Restoration Contractors working on stone restoration shall have seven (7) continuous years of experience, in the restoration of masonry facades. Contractors shall possess all necessary licenses, certifications, or other written approvals as required by the manufacturer for execution of the work specified in this section.
    - a. Field Supervision: The Masonry Restoration Contractor shall maintain a steady work crew consisting of qualified craftsmen and full time supervisor(s), on site daily, with a minimum of seven (7) years of successful experience. Supervisors shall not be changed during the Project except for causes beyond control of the Masonry Restoration firm. The Masonry Restoration Contractor shall confirm that all workers under his direction fully understand the requirements of the job.
    - b. Qualification of Workers: The Masonry Restoration Contractor shall demonstrate that the masons performing the Work have competence in completing the historic restoration work specified in this section.
      - 1) For patch repairs, crack repairs, and Dutchman installation, assign at least one (1) worker among those performing the specific type of work who is trained and certified by the manufacturer to apply its products.
      - 2) Experience installing standard unit masonry or new stone masonry is not sufficient experience for stone restoration work.
- C. Source Limitations: Obtain each type of material for stone restoration (stone, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.
- D. Appearance Standard: Restored, repaired and cleaned surfaces are to have a uniform appearance as viewed from 20 feet away by Architect. Perform additional repairs of small areas that are noticeably different, so that surface blends smoothly into surrounding areas.
- E. Mockups: Prepare mockups of restoration and associated local cleaning as follows to demonstrate aesthetic effects and qualities of materials and execution. Prepare mockups on existing walls under same weather conditions to be expected during remainder of the Work.

1. Stone: Provide mockups of each numbered type of masonry restoration work indicated on the drawings and in Article 1.2 of this Section:
  - a. ST-1 STONE DISPLACEMENT / AREA REBUILD One stone unit.
  - b. ST-2 AREA OF REPOINTING
    - 1) For each mockup required for work types numbered ST-2-a, ST-2-b, ST-2-c, provide two-part mockups in two stages at each location. First part of mockup shall be of raked-out joints in each location; second part of mockup shall repoint half of areas in each location and include one length of lead weathercap, leaving the raked-out joints open in the other half during the performance of other work of this type. Obtain Architect's review of first stage mockup before preparing second stage mockup. Obtain Architect's approval of technician's qualifications submittal before starting work.
    - 2) ST-2-a: Two locations, one per mortar color. Each location to be 6' x 4' (24 square feet). Include at least two vertical joints and two horizontal joints at each location.
    - 3) ST-2-b: Two locations, one per mortar color. Each location to be 6' x 4' (24 square feet). Include at least two vertical joints and two horizontal joints at each location.
    - 4) ST-2-c: One location, to be 6' x 4' (24 square feet). Include at least two vertical joints and two horizontal joints.
  - c. ST-3 STONE PATCH REPAIR: One location, (9) square inches minimum.
  - d. ST-4 DUTCHMAN REPAIR: One location.
  - e. ST-6 NON-STRUCTURAL CRACK REPAIR: Two locations, minimum one lineal foot in length each.
  - f. ST-7 STRUCTURAL CRACK REPAIR: Two locations, minimum one lineal foot in length each.
  - g. ST-8 LOOSE MATERIAL REMOVAL: One location, (144) square inches.
  - h. ST-10 STUCCO REPAIR: One location, (36) square inches.
  - i. ST-11 STONE REPLACEMENT: One unit of each stone type indicated on drawings: LLenroc ashlar.
- F. Review by Architect: Submittals, mockups and work in progress will be subject to review by architect. Contractor shall communicate with Architect to coordinate site visits and reports with progress of construction, and to ensure Architect access to work in progress before scaffolding is removed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- D. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.6 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit stone restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.
- B. Repoint mortar joints and repair stone only when air temperature is between and **40 and 90 deg F** and is predicted to remain so for at least 7 days after completion of work.
- C. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of **90 deg F** and above.
- D. Clean stone surfaces only when air temperature is 40 deg F (4 deg C) and above and is predicted to remain so for at least 7 days after completion of cleaning.

1.7 SEQUENCING AND SCHEDULING

- A. Order replacement materials at earliest possible date, to avoid delaying completion of the Work.
- B. Perform stone restoration work in the following sequence:
  - 1. Remove plant growth as required to perform Work indicated.
  - 2. Perform initial water washdown of exposed stone masonry surfaces.
  - 3. Rake out mortar from joints surrounding stone to be replaced, and from joints adjacent to stone repairs along joints.
  - 4. Repair existing stonework, including replacing existing stone with salvaged stone units or materials.
  - 5. Rake out joints that are to be repointed.
  - 6. Point mortar joints.
  - 7. Perform final water washdown of exposed stone masonry surfaces.

- C. Scaffolding: If scaffolding is used, patch anchor holes used to attach scaffolding after scaffolding removal. Anchor at joints only; do not anchor into stone units.

## PART 2 - PRODUCTS

### 2.1 LEED REQUIREMENTS

- A. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
  - 1. Provide products with Third Party Environmental Product Declaration (EPD) whenever possible.
- B. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
  - 1. Provide products with publicly available material inventories whenever available.

### 2.2 MASONRY MATERIALS

- A. Stone: Use salvaged stone material and new stone material matching existing, as follows below:
  - 1. Salvaged stone: Use salvaged stone to the greatest extent achievable. Obtain salvaged stone from locations of stone removal at the building as indicated on the drawings. Exercise reasonable care in removal of existing stone so that it remains suitable for re-installation.
  - 2. Before proposing use of salvaged stone, conduct a meeting at the building attended by the masonry restoration subcontractor and the Architect, at which the Architect will:
    - a. Review and compare locations and quantities of stone to be replaced and stone available for salvage and re-installation. Contractor and Architect should be provided access to salvage locations on staging or a mechanical lift.
    - b. Direct the contractor as to which existing stone units should be salvaged, and which should be discarded.
    - c. Identify areas where salvaged stone is preferred, and areas (if any) where replacement stone is allowed.
  - 3. Replacement stone: Use new stone only to supplement quantity of salvaged stone material.
    - a. Llenroc replacement stone material: "Adirondack Granite", available from Adirondack Natural Stone, Whitehall NY. The owner has identified this material as a stone to be considered for use where an appearance similar to Llenroc is desired, durability is preferred, and new stone masonry is not directly adjacent to existing stone masonry.

- b. Limestone replacement stone material: Provide Indiana Limestone. For contractor's information, the construction documents for the original masonry construction indicate "Buff Bedford Limestone", a trade name for a type of Indiana Limestone.
  - B. Brick masonry units: Provide building (common) brick, ASTM C 62, Grade SW.
    - 1. Size: Match size of existing building brick adjacent.
    - 2. Application: Use where brick is indicated for concealed locations.
- 2.3 MORTAR MATERIALS:
- A. Mortar, General: The Intent of Work of this Section is to provide new mortar as required to meet the requirement of this Work that matches existing mortar to remain in place, to include, but not be limited to, color, texture and composition.
  - B. Portland Cement: ASTM C 150, Type I or Type II, white or gray or both where required for color matching of exposed mortar. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
  - C. Hydrated Lime: ASTM C 207, Type S.
  - D. Mortar Sand: ASTM C 144 unless otherwise indicated.
    - 1. For pointing mortar, provide sand with rounded edges.
    - 2. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
  - E. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
  - F. Water: Potable.
- 2.4 MORTAR MIXES
- A. Mortar Mixes, General: New mortar shall visually match existing mortar.
  - B. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
    - 1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

- C. Do not use admixtures in mortar unless otherwise indicated.
- D. Mortar Proportions: Mix mortar materials in the following proportions:
  - 1. Pointing Mortar for Stone: 1 part white portland cement, 1 part lime, and 6 parts sand. Add mortar pigments to produce mortar colors required.
  - 2. Rebuilding (Setting) Mortar: Comply with ASTM C 270, Proportion Specifications, Type N unless otherwise indicated, with cementitious materials limited to portland cement and lime.

## 2.5 JOINT SEALANTS

- A. Self-Leveling Elastomeric Sealant for Skyfacing Joints in Pavements/Stairs: Self-leveling, two-component, polyurethane-based sealant complying with ASTM C 920, Type M, Class 25, Uses Related to Exposure T, Uses Related to Joint Substrates M and O, and complying with ASTM C 1247 requirements for sealants exposed to continuous immersion in liquids. Provide DynaTred as manufactured by Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438 (800-523-6688), or approved equal.
  - 1. Color: Architect may select color from full line of manufacturer's standard colors, or require a custom color.
- B. Elastomeric Sealant for Bed Joints in Stairs: Multi-component, high-performance polyurethane-based sealant complying with ASTM C 920, Type M, Grade NS, Class 50, Uses Related to Exposure T, Uses Related to Joint Substrates M and O and complying with ASTM C 719 requirements for  $\pm 50$  percent movement capability. Provide DynaTrol II as manufactured by Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438 (800-523-6688), or approved equal.
  - 1. Color: Architect may select color from full line of manufacturer's standard colors, or require a custom color

## 2.6 JOINT SEALANT BACKING

- A. General: Provide sealant backings that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer in each case based on field experience and laboratory testing.
- B. Cylindrical Plastic Foam Joint Fillers (Backer Rod): Preformed, compressible, resilient, nonstaining, nonwaxing, nonoutgassing strips of flexible plastic foam complying with ASTM C 1330, Type B, of material recommended by sealant manufacturer and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance. Provide Sof Rod as manufactured by Nomaco Inc., 501 NMC Drive, Zebulon, NC 27597 (800-345-7279), or approved equal.

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.7 STUCCO

- A. Provide lime-cement based mix, with stained finish; at locations indicated on the drawings.
  - 1. Basis of Design Products:
    - a. Universalputz Standard Historic Mix Plaster/Stucco, manufactured by Keim Mineral Coatings.
    - b. Restauro Pigmented Mineral Stain, manufactured by Keim Mineral Coatings.

## 2.8 LEAD WEATHERCAP JOINT PROTECTION MATERIALS

- A. Weathercap Type A (flat) cap and Type B (cove) cap as required by configuration of joint being sealed; or approved equal. Available from Weathercap, Inc, P.O. Box 1776, Slidell, LA 70459, (985) 649-4000.
- B. Exterior grade caulk, in which to set the cap; refer to Division 7 Section "Exterior Joint Sealants" for specification of products.
- C. Closed-cell foam backer rod.

## 2.9 REPAIR MATERIALS

- A. Stone Anchors: Fabricate anchors and dowels from Type 304 stainless steel
  - 1. "Pinning" anchors: Hilti HIS-RN stainless steel blind pins, 3/8" diameter or as indicated on drawings.
  - 2. Dowels at coping: Stainless steel dowel, 3/8" diameter or as indicated on drawings.
  - 3. Epoxy for setting pinning anchors and dowels: Hilti HIT-HY 270.
- B. Stone Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching stone.
  - 1. Products: Subject to compliance with requirements, provide one of the following
    - a. Cathedral Stone Products, Inc.; Jahn Restoration Mortars.
    - b. Conproco Corporation; Mimic.
    - c. Edison Coatings, Inc.; Custom System 45.
  - 2. Use formulation that is vapor- and water permeable (equal to or more than the stone), exhibits low shrinkage, has lower modulus of elasticity than the stone units being repaired, and develops high bond strength to all types of stone.



3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
  4. Formulate patching compound in colors, textures, and grain to match stone being patched. Provide sufficient number of colors to enable matching each piece of stone.
- C. Cementitious Crack Filler: An ultrafine superplasticized grout that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all types of stone.
1. Products: Subject to compliance with requirements, provide one of the following
    - a. Cathedral Stone Products, Inc.; Jahn Injection Grout.
    - b. Conproco Corporation; Granite Finish.
    - c. Edison Coatings, Inc.; Pump-X 53-Series.

## 2.10 CLEANING MATERIALS

- A. Water: Clean, potable, non-staining, and free of oils, acids, alkalis, salts, and organic matters.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F (60 to 71 deg C).
- C. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
1. Products: Subject to compliance with requirements, provide one of the following
    - a. Dominion Restoration Products, Inc.; Bio-Cleanse.
    - b. Dumond Chemicals, Inc.; Safe n' Easy Architectural Cleaner/Restorer.
    - c. Price Research, Ltd.; Price Non-Acid Masonry Cleaner.
    - d. PROSOCO; Enviro Klean 2010 All Surface Cleaner.
- D. Acidic Cleaner: Manufacturer's standard acidic masonry cleaner composed of hydrofluoric acid or ammonium bifluoride blended with other acids, detergents, wetting agents, and inhibitors.
1. Products: Subject to compliance with requirements, provide one of the following
    - a. Diedrich Technologies Inc.; Architectural and Specialty Masonry Cleaner
    - b. Dumond Chemicals, Inc.; Safe n' Easy Ultimate Stone and Masonry Cleaner.
    - c. PROSOCO; Enviro Klean Restoration Cleaner, Sure Klean Restoration Cleaner or, or Light Duty Restoration Cleaner.
    - d. Shorebest, 2100 ProStore Restoration Cleaner or 2110 Restoration Cleaner
- E. Acidic Cleaner: Manufacturer's standard acidic liquid cleaner for removal of mortar from stone surfaces.
1. Products: ProSoCo "SureKlean Vana Trol" or approved equal.

2.11 CLEANING EQUIPMENT

- A. Brushes: Natural or nylon fiber bristle only. Wire brushes shall not be used.
- B. Hand Tools: Scrapers and application paddles shall be made of wood or plastic with rounded edges. Metallic tools shall not be used.
- C. Spray Equipment for Chemical Cleaners: Low-pressure tank or chemical pump with stainless steel, cone shaped spray tip.
- D. Spray Equipment for Water: Equipment capable of controlled spray application of water at pressures, volumes, and temperature required, with not less than 15 degrees fan shaped spray tip, with pressure gauges at the spray controls.

2.12 MISCELLANEOUS MATERIALS

- A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
  - 1. Products: Subject to compliance with requirements, provide one of the following
    - a. ABR Products, Inc.; Rubber Mask.
    - b. Price Research, Ltd.; Price Mask.
- B. PROSOCO; Sure Klean Strippable Masking.
- C. Weeps: Fabricate from cotton cord or rope.
- D. Sealant: Refer to Division 7 Section "Exterior Joint Sealants" for specification of products.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from stone restoration work.
- B. Provide temporary weather protection to ensure a watertight building envelope at all times and to prevent damage to structure and building interiors.
- C. Protect existing exposed masonry, and limit work operations to the scope of work indicated on the contract documents. It shall not be the contractor's option to subject the existing masonry to unreasonable soiling or damage during the execution of the work, and to then repair or clean it. Should the contractor cause damage to masonry or any other building materials, the contractor shall repair all such damage at his own cost

and at no cost to the Owner, but may proceed with such repair only after the Architect's approval of a written and graphical repair work plan prepared by the Contractor.

- D. Prevent all cleaning materials, patching materials, crack fillers, coating materials, and mortar from staining face of surrounding masonry and other surfaces.
  - 1. Cover sills, ledges, and projections to protect from mortar droppings.
  - 2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
  - 3. Immediately remove mortar in contact with exposed masonry and other surfaces.
  - 4. Clean mortar splatters from scaffolding at end of each day.

### 3.2 UNUSED ANCHOR REMOVAL

- A. Remove masonry anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.
  - 1. Remove items carefully to avoid spalling or cracking stone.
  - 2. If item cannot be removed without damaging surrounding stone, cut off item flush with surface and core drill surrounding stone and item as close around item as practical.
  - 3. Patch holes where items were removed unless directed to remove and replace units.

### 3.3 PLANT REMOVAL

- A. Remove all plants at locations of masonry restoration work indicated in Part 3 of this section, including digging up the roots, prior to performance of work at each location. Include removal of plant roots at the base of the exterior wall within ten feet to the right or left of a point at the base of the wall directly below the repair location. At exterior wall surfaces, remove remaining pods, branches and stems using a soft, natural bristle brush.

### 3.4 FIELD QUALITY CONTROL

- A. Mortar Mixing: Prepare all mortar mixes on site, from materials specified in Part 2.
- B. Notify Architect in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until Architect has had reasonable opportunity to make observations of work areas at lift device or scaffold location.

### 3.5 MASONRY RESTORATION – GENERAL

- A. An effort shall be made to minimize the need for on-site storage of masonry materials. Close coordination of the field personnel, material suppliers and the general contractor

shall be maintained to provide for a steady flow of materials on a close to as-needed basis.

- B. Document all existing masonry during dismantling, including wall thicknesses, pilaster sizing and layout, window and door openings, bearing locations and critical coursing elevations. All documentation shall be recorded on sketches with true dimensions, stored both on site and offsite. All reconstructed work shall geometrically replicate the original construction.
- C. All dismantled work shall be fully documented and the original geometry of the structure (before bulging and sagging) be established. Reconstruction shall be done to replicate original geometry.
- D. Inspect all masonry within work areas, identify all required repairs and removals.
- E. Perform all other indicated masonry work in accordance with the requirements of this section and all references.

### 3.6 REMOVAL OF DESIGNATED OR DAMAGED MASONRY

- A. Provide and install all temporary shoring, bracing and support to surrounding construction before beginning removal. Removal shall be done slowly and methodically to maintain stability to all remaining elements at all times. Contractor shall be responsible for maintaining integrity and safety of surrounding construction, in general, during work.
- B. Carefully remove designated masonry, maintaining support to all surrounding and supported elements that are otherwise dependent upon the masonry being removed for support or stability. Following removal of the exterior veneer units, remove all remaining back-up masonry, storing both in separate locations. Clean and store all salvageable stone and brick units for re-use, provide replacement bricks for units that cannot be re-used.
- C. Following removal of designated masonry, inspect and remove additional masonry that is loose, damaged or can be separated with unassisted hands.
- D. Clean the exposed surfaces of the remaining material, and remove shards of material that have become loose during work or have shifted from their proper positions. Notify the Architect immediately of the number of brick wythes that need to be removed before proceeding with work.
- E. Notify the Architect of any masonry beyond immediate work area, which becomes loosened during work. Stop work immediately, provide additional bracing and review with the Architect before resuming.
- F. Protect the existing interior structure from the external weather and from dust and debris caused by these operations. Provide weather protection as needed until the exterior envelope is restored.

### 3.7 MASONRY CLEANING, GENERAL

- A. Scope: Refer to Part 1 of this section for a description of the scope of masonry cleaning.
- B. Intent: The intent of the cleaning is 1) to ensure that each repair matches the existing masonry surrounding it, and 2) to produce building elevations that, while containing both cleaned and uncleaned masonry, are reasonably consistent in appearance, as the Architect shall judge.
- C. Area to be cleaned: Clean all exposed masonry surfaces for which this Section indicates work, including removal, salvage, repair, replacement, repointing, in numbered drawing notes or any work otherwise indicated on the drawings or in this Section, as follows below.
  - 1. The individual stones removed, salvaged, repaired, etc.
  - 2. The surrounding existing stone or parent stone, consisting of an area no less than one full stone in each direction of exposed existing masonry from the limit of the repair, or two full stones where one full stone measures less than twelve inches. Include cleaning of the existing joint at the far side of the existing stone(s).
- D. Follow additional direction provided by Architect upon review of cleaning portion of mockups. Adjust degree, limit or type of cleaning during performance of the work as directed and as may be required to conform to appearance of accepted mockups.

### 3.8 MASONRY CLEANING PROCEDURES

- A. General Cleaning: Comply with chemical-cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical-cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
  - 1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
  - 2. Keep wall wet below area being cleaned to prevent streaking from runoff.
  - 3. Do not clean stonework during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
  - 4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property. Dispose of runoff from cleaning operations by legal means and in a manner that

prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

### 3.9 CLEANING STONEMASONRY

#### A. General:

1. Cleaning methods should be conducted in a methodical fashion beginning with the evasive (i.e. low-pressure water rinse) and continuing on to the stronger cleaning methods as needed.
2. Final method of cleaning will be determined through the mock-up process, including methodology of cleaning (top to bottom and right/left to left/right.) One cleaning method will be employed for cleaning, and one method for final washdown.
3. Protect adjacent flashing material from overspray from masonry cleaners.

#### B. Water and Detergent Cleaning:

1. Wet stone with water applied by low-pressure spray.
2. Scrub stone using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices.
3. Apply detergent solution if water alone does not work. Scrub stone with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that stone surface remains wet.
4. Rinse with water applied by low-pressure spray to remove detergent solution and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

#### C. Nonacidic Liquid Chemical Cleaning:

1. Wet stone with water applied by low-pressure spray.
2. Apply cleaner to stone by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
  - a. As recommended by chemical-cleaner manufacturer.
  - b. As established by mockup.
  - c. Two to three minutes.
3. Rinse with water applied by low-pressure spray to remove chemicals and soil.

- D. Acidic Chemical Cleaning:
  - 1. Wet stone with cold water applied by low-pressure spray.
  - 2. Apply cleaner to stone by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
    - a. As recommended by chemical-cleaner manufacturer.
    - b. As established by mockup.
    - c. Two to three minutes.
  - 3. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
- E. Poulticing:
  - 1. Prepare poultice solution as per manufacturer's instructions.
  - 2. Apply paste mixture to stone surface with a small trowel or putty knife. Cover paste area with polyethylene to prevent dehydration and leave until fully dried.
  - 3. When paste has dried, remove with wooden or other non-metallic spatula. Be sure to remove all traces of the poultice paste.
  - 4. Repeat procedure described above until stain has been satisfactorily reduced or removed.

### 3.10 ADJUSTMENT AND CLEANING

- A. Adjustment: Correct work of this Section that does not meet requirements of this Specification to Architect's satisfaction at no additional cost to Owner.
- B. Cleaning Restored Stone Masonry: Clean stone masonry affected by work of this Section to remove mortar, grout, adhesive, and other contaminants using approved methods to provide clean surfaces matching the condition of the surfaces cleaned to comply with requirements of Section 04 93 00 before work of this Section was begun.
- C. Site Cleaning: At completion of stone masonry restoration work, remove debris and left over materials from site and leave site broom clean.

### 3.11 MASONRY RESTORATION – NUMBERED DRAWING NOTES

- A. General: Articles below correspond to numbered keynotes on the drawings and to other quantities of work not shown on drawings but indicated in Part 1 of this Section. Detailed scope of work and execution requirements are indicated at each item.
- B. Work indicated in Adjustment and Cleaning article in this section is part of the work of each Masonry Restoration article indicated below.

3.12 ST1 - Area Rebuild

- A. General: Install salvaged stone units in their original locations as indicated on Drawings. Do not damage stone units. Repair and replace stone units damaged during work of this Section as directed by Architect and to Architect's satisfaction at no additional cost to Owner.
- B. Cleaning Stone: Clean stone before setting. Remove old mortar from salvaged stone and scrub stone with detergent and water using natural or synthetic fiber bristle brushes. Thoroughly rinse salvaged stone and new stone with clean water.
- C. Anchor Holes: Where indicated on Drawings, necessitated by conditions at site, and as shown on approved shop drawings, drill new holes and mortises to receive anchors, cramps, dowels, and other attachment elements. Use rotary drills, masonry saws, and other methods that do not damage stone. Do not use hammer drills or other percussive tools.
- D. Cleaning Holes: Use stiff bristle brushes and filtered, oil-free compressed air to thoroughly remove dust and debris from holes to receive pins. Brush surfaces at sides of holes vigorously and blow free of contaminants.
- E. Setting: Set salvaged stone units accurately with new stainless steel threaded rods, seismic anchors, continuous stainless steel wire, and fresh mortar to match condition of original masonry as shown on the Drawings. Set true to line and level and fill joints and anchor holes completely with mortar.
  - 1. Joint Widths: Set stone units with joints of uniform width not exceeding width of existing joints.
  - 2. Set stones such that their weight is supported by shims, not the mortar bed. In bed joint (horizontal joint), use two shims per stone, approximately at midpoint of width and quarter points of length. Recess shims at least 1 in. from the face of stone to permit adequate mortar coverage. Ensure that the stone is fully bedded in mortar.
  - 3. Lay bed mortar and immediately set stone to prevent drying out of mortar. Do not furrow bed joints. Completely butter the ends of each stone with mortar and shove the stone into place so that mortar squeezes out of the top of the head joint and bed joint. Rake out mortar to a depth of 5/8 in. from the exterior face of the stone to accommodate final pointing.
- F. Defects: Patching of defects in stone blocks shall not be permitted. Redress stone units with chips on faces and clean stone units with stains on faces. No acid-leaching agent shall be permitted.
- G. Preparation for Pointing: Upon completion of setting stonework, rake joints to prepare them for pointing in compliance with Article "Repointing and Deep Repointing Joints," below.



3.13 ST2A - Area Repointing Mortar

A. Preparing Joints Containing Mortar

1. General: Remove mortar from joints to a depth of 3/4 inch, to 2-1/2 times width of joint, or to sound mortar, whichever is deepest. In all cases remove deteriorated, weathered, and loose material to sound mortar.
  - a. Completely remove mortar from surfaces of masonry units adjoining joint to allow new mortar to bond directly with masonry units.
  - b. Cut surface of mortar at rear of joint at a uniform depth from and parallel to wall surface.
  - c. Do not damage faces or arrises of masonry units during joint preparation. Cease joint preparation work if, in Architect's judgment, masonry units are damaged by methods being used to prepare joints. Do not resume work until tools, workers, and methodology have been corrected to ensure that masonry units are not damaged and that work meets standard set by approved mock-up.
  - d. Mortar Removal in Locations Indicated to Receive Deep Pointing: Remove loose mortar to sound mortar. Use wedges, shims, and/or other approved methods to prevent displacement of masonry units during removal of mortar.
2. Mortar Removal Using Hand Tools: Use hand tools for removal of mortar from joints in masonry that are less than 6 inches long and from other joints in which use of power tools might damage masonry units. Use hand tools to complete mortar removal from joints where power tools have been used to partially remove mortar.
  - a. For narrow joints of 1/8-inch or less in width, rake mortar from joints manually with a sharp knife blade or cutter made for this purpose. Cutter may be used with or without aid of a hammer.
  - b. Sharpen chisels as often as necessary to provide for optimum cutting of mortar and to minimize chipping but at least hourly.
3. Mortar Removal Using Power Tools
  - a. Demonstrated Ability of Mechanics: Prior to beginning work, demonstrate that workers using power tools are proficient in use of power tools for joint preparation. Failure to demonstrate to Architect's satisfaction that each worker is proficient in the use of each type of power tool proposed for use and that power tool joint preparation does not result in damage to masonry units shall result in prohibition of use of power tools for joint preparation. If proficiency is not demonstrated, or if work in progress results in damage to masonry to remain, power tool work shall cease, and joints shall be prepared for pointing using only hand-powered tools.
  - b. Rotary Power Tools: With Architect's specific prior approval following successful demonstrations of skill by mechanics, power grinders and/or pneumatic grinders may be used to partially remove mortar from joints longer than 6 inches in masonry where there is no danger of cutting into adjacent stone units.

Limitations on Use of Electric Power Grinders: Do not use electric power grinders on joints less than 3/16-inch wide or less than 6 inches long or where ornament, elaborate profile, or other surface irregularity might make damage to masonry units likely.

Limitations on Use of Modified Pneumatic Die Grinders: Do not use modified pneumatic die grinders with custom thin blades on joints less than 1-1/2 times the width of the grinder blade.

Extent of Mortar Removal Using Power Grinders: Use power grinder only to score one kerf cut in center of each joint to depth of mortar removal indicated. Remove remaining mortar from sides of joint using hand tools or, if approved, pneumatically powered chisels. Stop kerf at least 4 inches from inside corners and projecting elements. Remove remaining mortar using hand tools or pneumatically powered chisels.

Jigs: Construct jigs to guide and limit power tools as necessary to prevent damage to adjacent masonry units.

- c. Pneumatic Heads with Chisels: With Architect's specific prior approval following successful demonstrations of skill by mechanics, pneumatically powered chisels may be used to remove mortar from joints in place of hand tools. If work using pneumatically powered chisels results in damage to masonry to remain, work using pneumatic chisels shall cease, and joints shall be prepared using hand tools or other approved methods that do not result in damage to masonry units.
  - d. Reciprocating Brick and Mortar Saw: With Architect's specific prior approval following successful demonstrations of skill by mechanics, a reciprocating saw specifically designed for removal of mortar from joints in masonry may be used to partially remove mortar from joints 3/8-inch wide or wider where there is no danger of cutting into adjacent stone units. If work using reciprocating brick and mortar saw results in damage to masonry to remain, work using reciprocating brick and mortar saw shall cease, and joints shall be prepared using hand tools or other approved methods that do not result in damage to stone units.
  - e. Hand-Held Multipurpose Oscillating Tool with Diamond Blades: With Architect's specific prior approval following successful demonstrations of skill by mechanics, a hand-held multipurpose oscillating tool with diamond blades may be used to partially remove mortar from joints where there is no danger of cutting into adjacent masonry units. If work using multipurpose oscillating tool results in damage to masonry to remain, work using multipurpose oscillating tool shall cease, and joints shall be prepared using hand tools or other approved methods that do not result in damage to masonry units.
4. Removal of Grout from Paving Joints: Remove grout from paving in locations indicated on Drawings using hand tools (mallets and chisels) or pneumatically operated chisels as approved by Architect.
  5. Cleaning: Remove loose mortar and foreign material from raked joints using a fine, stiff natural- or synthetic-fiber bristle brush. Remove remaining particles, dust, and dirt using clean, filtered, oil-free compressed air. Ensure that dust and dirt are not blown back into previously cleaned joints.
  6. Restoration and Replacement of Damaged Units: Repair and/or replace masonry units damaged during joint preparation to provide units in at least as good a condition as before joint preparation was begun to Architect's satisfaction at no additional cost to Owner.

B. Pointing Joints

1. Wetting: Thoroughly drench masonry with water 24 hours prior to pointing joints to saturate masonry. Thoroughly wet masonry again immediately before pointing joints and allow surfaces to dry slightly. At time of masonry pointing, surfaces shall be damp, so that they do not rapidly absorb moisture, but free of standing water (saturated, surface dry).
  - a. Failure to Properly Wet Substrate: Evidence that masonry to be pointed has not been properly dampened to prevent water in the mortar from being too rapidly absorbed by the masonry will be cause for Architect to reject pointing work. Remove rejected pointing, properly prepare joints for pointing, and provide new mortar to meet requirements of this Section at no additional cost to Owner.
  
2. Installing Mortar: Install mortar in joints as follows.
  - a. Using a long, thin masonry pointing trowel, tightly pack mortar into joints in layers not exceeding 1/4-inch thick to fill joint to match original sound joints.
  - b. Begin by filling areas from which mortar is missing to a depth greater than 3/4 inch in 3/8-inch-thick layers to within 3/4 inch of finished joint surface to provide a uniform substrate for final masonry pointing. Fill final 3/4-inch depth of joint continuously and uniformly in 1/4-inch-thick layers.

Joints to Be Deep Pointed: Install mortar to fill portions of joints more than 2 inches behind finished joint surface in layers not exceeding 1-inch thick. Fill portions of joint between 3/4 inches behind the finished joint surface and 2 inches behind the finished joint surface in 3/8-inch-thick layers to provide a uniform substrate for final masonry pointing. Fill final 3/4-inch depth of joint continuously and uniformly in 1/4-inch-thick layers.

- c. Firmly iron each layer to compact mortar and ensure full bond between mortar and masonry units and a firm, solid joint.
  - d. Allow each layer to reach thumbprint hardness before applying succeeding layer. Do not let previous layer dry out before applying succeeding layer. Construct uniform joints.
  - e. Do not spread mortar over edges onto exposed surfaces of masonry units. Do not featheredge mortar.
  - f. When stopping work at end of each day or for other reasons, stagger layers of mortar so that there will be no through joints in mortar inserted into joints. Stagger joints in layers so that they are at least 3 inches from each other.
  - g. Where applying new work to that of a prior day, dampen previous work to ensure good bond.
  
3. Tooling Joints: After final layer of mortar is "leather hard," tool joints with a flat rule jointer, or as directed by Architect.
  - a. Profile: Tool joints to profile as shown on Drawings or to match original joint profiles as directed by Architect. Solidly compress mortar so that it adheres well to masonry on both sides and forms a dense surface. Premature or late tooling will result in unacceptable finishes, which will be rejected.
  
4. Curing
  - a. Keep newly pointed joints damp for at least 72 hours after mortar has been inserted. Do not apply a direct stream of water to joints for at least 7 days after mortar has been placed.
  - b. Ensure masonry temperature remains as required by specifications until mortar is thoroughly cured.

C. Cleaning and Repairing Mortar Joints

1. Water Washing: Wash pointed masonry with clean filtered water and nonabrasive hand tools to remove mortar debris from masonry surfaces. Do not use chemical cleaners.
  - a. Wash within 72 hours following completion of masonry pointing.
  - b. Use blunt-edged wood scrapers, soft natural bristle brushes, and rough towels along with water to remove mortar debris. Do not use wire brushes. Do not scratch joint surfaces.
  - c. Stop cleaning masonry unit surfaces free of misapplied mortar if methods and materials used damage pointed joints. Do not resume cleaning masonry free of misapplied mortar until methods and materials have been changed to avoid damaging mortar in joints.
2. Repairing Pointed Joints: As cleaning progresses, examine joints to locate cracks, holes, and other defects. Carefully point up and fill such defects with mortar. Where joints are defective in opinion of Architect cut out joints to minimum depth of 3/4 inch or two-and-one-half times joint width, whichever is greater, properly prepare joint substrates, and provide new pointing mortar exercising extreme care to ensure that color matches that of adjacent masonry pointing work. Exposed joint surfaces shall be free from protruding mortar, holes, pits, depressions, and other defects.

- D. Correcting Unacceptable Joints: Should a crack occur in any joint surface, should mortar separate from a masonry unit, indicating that it did not form a strong mechanical and chemical bond with the unit, or should Architect determine that for another reason masonry pointing work does not equal or exceed the minimum standard established by the approved mock-up and comply with requirements of this Section, remove mortar to a minimum depth of 3/4 inch, properly prepare joint substrates, and repoint following requirements of this Section to Architect's satisfaction at no additional cost to Owner. At completion of work of this Section, joints shall be full of mortar soundly adhered to surfaces of masonry units at sides of joints and without defects.

3.14 ST2B - area repointing sealant

A. Preparing Joints Containing Mortar

1. General: Remove mortar from joints to a depth of 3/4 inch, to 2-1/2 times width of joint, or to sound mortar, whichever is deepest. In all cases remove deteriorated, weathered, and loose material to sound mortar.
  - a. Completely remove mortar from surfaces of masonry units adjoining joint to allow new mortar to bond directly with masonry units.
  - b. Cut surface of mortar at rear of joint at a uniform depth from and parallel to wall surface.
  - c. Do not damage faces or arrises of masonry units during joint preparation. Cease joint preparation work if, in Architect's judgment, masonry units are damaged by methods being used to prepare joints. Do not resume work until tools, workers, and methodology have been corrected to ensure that

- masonry units are not damaged and that work meets standard set by approved mock-up.
- d. Mortar Removal in Locations Indicated to Receive Deep Pointing: Remove loose mortar to sound mortar. Use wedges, shims, and/or other approved methods to prevent displacement of masonry units during removal of mortar.
2. Mortar Removal Using Hand Tools: Use hand tools for removal of mortar from joints in masonry that are less than 6 inches long and from other joints in which use of power tools might damage masonry units. Use hand tools to complete mortar removal from joints where power tools have been used to partially remove mortar.
    - a. For narrow joints of 1/8-inch or less in width, rake mortar from joints manually with a sharp knife blade or cutter made for this purpose. Cutter may be used with or without aid of a hammer.
    - b. Sharpen chisels as often as necessary to provide for optimum cutting of mortar and to minimize chipping but at least hourly.
  3. Mortar Removal Using Power Tools
    - a. Demonstrated Ability of Mechanics: Prior to beginning work, demonstrate that workers using power tools are proficient in use of power tools for joint preparation. Failure to demonstrate to Architect's satisfaction that each worker is proficient in the use of each type of power tool proposed for use and that power tool joint preparation does not result in damage to masonry units shall result in prohibition of use of power tools for joint preparation. If proficiency is not demonstrated, or if work in progress results in damage to masonry to remain, power tool work shall cease, and joints shall be prepared for pointing using only hand-powered tools.
    - b. Rotary Power Tools: With Architect's specific prior approval following successful demonstrations of skill by mechanics, power grinders and/or pneumatic grinders may be used to partially remove mortar from joints longer than 6 inches in masonry where there is no danger of cutting into adjacent stone units.

Limitations on Use of Electric Power Grinders: Do not use electric power grinders on joints less than 3/16-inch wide or less than 6 inches long or where ornament, elaborate profile, or other surface irregularity might make damage to masonry units likely.

Limitations on Use of Modified Pneumatic Die Grinders: Do not use modified pneumatic die grinders with custom thin blades on joints less than 1-1/2 times the width of the grinder blade.

Extent of Mortar Removal Using Power Grinders: Use power grinder only to score one kerf cut in center of each joint to depth of mortar removal indicated. Remove remaining mortar from sides of joint using hand tools or, if approved, pneumatically powered chisels. Stop kerf at least 4 inches from inside corners and projecting elements. Remove remaining mortar using hand tools or pneumatically powered chisels.

Jigs: Construct jigs to guide and limit power tools as necessary to prevent damage to adjacent masonry units.

- c. Pneumatic Heads with Chisels: With Architect's specific prior approval following successful demonstrations of skill by mechanics, pneumatically powered chisels may be used to remove mortar from joints in place of hand tools. If work using pneumatically powered chisels results in damage to masonry to remain, work using pneumatic chisels shall cease, and joints

- shall be prepared using hand tools or other approved methods that do not result in damage to masonry units.
- d. Reciprocating Brick and Mortar Saw: With Architect's specific prior approval following successful demonstrations of skill by mechanics, a reciprocating saw specifically designed for removal of mortar from joints in masonry may be used to partially remove mortar from joints 3/8-inch wide or wider where there is no danger of cutting into adjacent stone units. If work using reciprocating brick and mortar saw results in damage to masonry to remain, work using reciprocating brick and mortar saw shall cease, and joints shall be prepared using hand tools or other approved methods that do not result in damage to stone units.
  - e. Hand-Held Multipurpose Oscillating Tool with Diamond Blades: With Architect's specific prior approval following successful demonstrations of skill by mechanics, a hand-held multipurpose oscillating tool with diamond blades may be used to partially remove mortar from joints where there is no danger of cutting into adjacent masonry units. If work using multipurpose oscillating tool results in damage to masonry to remain, work using multipurpose oscillating tool shall cease, and joints shall be prepared using hand tools or other approved methods that do not result in damage to masonry units.
4. Removal of Grout from Paving Joints: Remove grout from paving in locations indicated on Drawings using hand tools (mallets and chisels) or pneumatically operated chisels as approved by Architect.
  5. Cleaning: Remove loose mortar and foreign material from raked joints using a fine, stiff natural- or synthetic-fiber bristle brush. Remove remaining particles, dust, and dirt using clean, filtered, oil-free compressed air. Ensure that dust and dirt are not blown back into previously cleaned joints.
  6. Restoration and Replacement of Damaged Units: Repair and/or replace masonry units damaged during joint preparation to provide units in at least as good a condition as before joint preparation was begun to Architect's satisfaction at no additional cost to Owner.
- B. Preparing Joints Containing Sealant
1. General: Remove sealant and sealant residue from joints using mechanical methods, solvent cleaners, and abrasive methods as necessary to provide clean masonry substrates suitable for optimum adhesion and performance of mortar without damaging faces of masonry units.
  2. Mechanical and Chemical Removal of Sealant and Sealant Residue: Remove as much of the sealant as possible using mechanical means, including cutting with sharp knives and other appropriate tools, and remove remaining sealant and sealant residue from joint substrates using approved chemical remover following requirements of Section 04 93 00 – "Masonry Cleaning." Do not damage surfaces of stone units to be exposed in finished work.

3. Abrasive Treatment of Substrate: Following protection of exposed surfaces of masonry units sufficient to prevent them from being damaged by abrasive removal of material from joints, use wire bristle brushes, metal scrapers, small grinders, low-pressure, airborne-abrasive blasting, or other approved method to remove remaining traces of sealant from joint substrates and to prepare joint substrates for optimum installation of mortar. Do not damage surfaces of masonry units to be exposed in finished work in any way. Do not widen joints.
4. Cleaning: Thoroughly remove dust and debris using clean, oil-free compressed air. Use care to ensure debris is not deposited in joints previously cleaned.
5. Removal of Mortar Behind Sealant: If removal of sealant leaves a joint with mortar closer than 3/4 inch or 2-1/2 times joint width, whichever is greater, to the face of the masonry or with loose or deteriorated mortar, remove mortar and clean joint free of debris to comply with requirements of Paragraph "Joint Preparation for Joints Containing Mortar," above.

C. Installation of Sealants

1. General: Install sealants as recommended by sealant manufacturer using proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration without air pockets, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow maximum sealant movement. Install sealants at same time sealant backings are installed.
2. Depths and Geometry: Install sealants with profiles as shown on Drawings and as recommended by sealant manufacturer and approved by Architect.
  - a. Widths Not Exceeding 1/4 Inch: Sealant depth shall equal sealant width.
  - b. Widths Over 1/4 Inch: Sealant depth shall be 1/2 width of joint up to 1/2 inch maximum depth at center of joint with sealant thickness at center of joint equal to approximately 1/2 of depth at adhesion surface.
3. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
4. Provide flush joint configuration as shown in Figure 5B in ASTM C 1193, unless otherwise indicated.
5. Clean off excess sealant and sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products adjacent to joints in which sealant is installed.
6. Protection: Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so that they are without damage or deterioration at time

of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged joint sealants and deteriorated joint sealants immediately, properly prepare joints, and provide new sealants so that installations with repaired areas are indistinguishable from original work.

7. Adjustment: Remove joint sealant work that does not comply with requirements of this Section as determined by Architect and replace to meet requirements of this Section at no additional cost to Owner.

3.15 ST2C - Lead Weathercaps

- A. General: Install lead joint covers in locations indicated on Drawings following manufacturer's recommendations and as indicated on Drawings.
  1. Install sealants to comply with requirements of Section 07 92 00 – "Joint Sealants."
- B. Ensure that joint has been pointed to appropriate depth from surface to allow optimum installation of joint cover.
- C. Prepare surfaces at sides of joint. Clean surfaces free of contaminants that might adversely affect adhesion and performance of sealant.
- D. Install backer rod or bond breaker tape in raked joint. Position so that surface of rod or tape is at least depth of anchor plus 1/4-inch behind surface of masonry.
- E. Protect face of masonry to either side of joint cover location using masking tape or other tested method to prevent sealant from contact with surfaces of masonry units to be exposed in finished work.
- F. Prime surfaces to receive sealant if recommended by sealant manufacturer for optimum performance of sealant. Install sealant to fill joint and project approximately 1/8-inch above masonry surface. Comply with requirements of Section 07 92 00 – "Joint Sealants."
- G. Install joint cover, pressing securely into sealant and forming cleanly to profile of masonry units. Joint covers shall be continuous. Do not join sections of joint cover unless joints exceed maximum length of material.
- H. Remove excess sealant and protection from masonry surface.

3.16 ST2D - Deep Repointing Mortar

- A. Preparing Joints Containing Mortar
  1. General: Remove mortar from joints to a depth of 3/4 inch, to 2-1/2 times width of joint, or to sound mortar, whichever is deepest. In all cases remove deteriorated, weathered, and loose material to sound mortar.



- a. Completely remove mortar from surfaces of masonry units adjoining joint to allow new mortar to bond directly with masonry units.
  - b. Cut surface of mortar at rear of joint at a uniform depth from and parallel to wall surface.
  - c. Do not damage faces or arrises of masonry units during joint preparation. Cease joint preparation work if, in Architect's judgment, masonry units are damaged by methods being used to prepare joints. Do not resume work until tools, workers, and methodology have been corrected to ensure that masonry units are not damaged and that work meets standard set by approved mock-up.
  - d. Mortar Removal in Locations Indicated to Receive Deep Pointing: Remove loose mortar to sound mortar. Use wedges, shims, and/or other approved methods to prevent displacement of masonry units during removal of mortar.
2. Mortar Removal Using Hand Tools: Use hand tools for removal of mortar from joints in masonry that are less than 6 inches long and from other joints in which use of power tools might damage masonry units. Use hand tools to complete mortar removal from joints where power tools have been used to partially remove mortar.
- a. For narrow joints of 1/8-inch or less in width, rake mortar from joints manually with a sharp knife blade or cutter made for this purpose. Cutter may be used with or without aid of a hammer.
  - b. Sharpen chisels as often as necessary to provide for optimum cutting of mortar and to minimize chipping but at least hourly.
3. Mortar Removal Using Power Tools
- a. Demonstrated Ability of Mechanics: Prior to beginning work, demonstrate that workers using power tools are proficient in use of power tools for joint preparation. Failure to demonstrate to Architect's satisfaction that each worker is proficient in the use of each type of power tool proposed for use and that power tool joint preparation does not result in damage to masonry units shall result in prohibition of use of power tools for joint preparation. If proficiency is not demonstrated, or if work in progress results in damage to masonry to remain, power tool work shall cease, and joints shall be prepared for pointing using only hand-powered tools.
  - b. Rotary Power Tools: With Architect's specific prior approval following successful demonstrations of skill by mechanics, power grinders and/or pneumatic grinders may be used to partially remove mortar from joints longer than 6 inches in masonry where there is no danger of cutting into adjacent stone units.

Limitations on Use of Electric Power Grinders: Do not use electric power grinders on joints less than 3/16-inch wide or less than 6 inches long or where ornament, elaborate profile, or other surface irregularity might make damage to masonry units likely.

Limitations on Use of Modified Pneumatic Die Grinders: Do not use modified pneumatic die grinders with custom thin blades on joints less than 1-1/2 times the width of the grinder blade.

Extent of Mortar Removal Using Power Grinders: Use power grinder only to score one kerf cut in center of each joint to depth of mortar removal indicated. Remove remaining mortar from sides of joint using hand tools or, if approved, pneumatically powered chisels. Stop kerf at least 4 inches from inside corners and projecting elements. Remove remaining mortar using hand tools or pneumatically powered chisels.

Jigs: Construct jigs to guide and limit power tools as necessary to prevent damage to adjacent masonry units.

- c. Pneumatic Heads with Chisels: With Architect's specific prior approval following successful demonstrations of skill by mechanics, pneumatically powered chisels may be used to remove mortar from joints in place of hand tools. If work using pneumatically powered chisels results in damage to masonry to remain, work using pneumatic chisels shall cease, and joints shall be prepared using hand tools or other approved methods that do not result in damage to masonry units.
  - d. Reciprocating Brick and Mortar Saw: With Architect's specific prior approval following successful demonstrations of skill by mechanics, a reciprocating saw specifically designed for removal of mortar from joints in masonry may be used to partially remove mortar from joints 3/8-inch wide or wider where there is no danger of cutting into adjacent stone units. If work using reciprocating brick and mortar saw results in damage to masonry to remain, work using reciprocating brick and mortar saw shall cease, and joints shall be prepared using hand tools or other approved methods that do not result in damage to stone units.
  - e. Hand-Held Multipurpose Oscillating Tool with Diamond Blades: With Architect's specific prior approval following successful demonstrations of skill by mechanics, a hand-held multipurpose oscillating tool with diamond blades may be used to partially remove mortar from joints where there is no danger of cutting into adjacent masonry units. If work using multipurpose oscillating tool results in damage to masonry to remain, work using multipurpose oscillating tool shall cease, and joints shall be prepared using hand tools or other approved methods that do not result in damage to masonry units.
4. Removal of Grout from Paving Joints: Remove grout from paving in locations indicated on Drawings using hand tools (mallets and chisels) or pneumatically operated chisels as approved by Architect.
  5. Cleaning: Remove loose mortar and foreign material from raked joints using a fine, stiff natural- or synthetic-fiber bristle brush. Remove remaining particles, dust, and dirt using clean, filtered, oil-free compressed air. Ensure that dust and dirt are not blown back into previously cleaned joints.
  6. Restoration and Replacement of Damaged Units: Repair and/or replace masonry units damaged during joint preparation to provide units in at least as good a condition as before joint preparation was begun to Architect's satisfaction at no additional cost to Owner.

B. Pointing Joints

1. Wetting: Thoroughly drench masonry with water 24 hours prior to pointing joints to saturate masonry. Thoroughly wet masonry again immediately before pointing joints and allow surfaces to dry slightly. At time of masonry pointing, surfaces shall be damp, so that they do not rapidly absorb moisture, but free of standing water (saturated, surface dry).

- a. Failure to Properly Wet Substrate: Evidence that masonry to be pointed has not been properly dampened to prevent water in the mortar from being too rapidly absorbed by the masonry will be cause for Architect to reject pointing work. Remove rejected pointing, properly prepare joints for pointing, and provide new mortar to meet requirements of this Section at no additional cost to Owner.
2. Installing Mortar: Install mortar in joints as follows.
    - a. Using a long, thin masonry pointing trowel, tightly pack mortar into joints in layers not exceeding 1/4-inch thick to fill joint to match original sound joints.
    - b. Begin by filling areas from which mortar is missing to a depth greater than 3/4 inch in 3/8-inch-thick layers to within 3/4 inch of finished joint surface to provide a uniform substrate for final masonry pointing. Fill final 3/4-inch depth of joint continuously and uniformly in 1/4-inch-thick layers.

Joints to Be Deep Pointed: Install mortar to fill portions of joints more than 2 inches behind finished joint surface in layers not exceeding 1-inch thick. Fill portions of joint between 3/4 inches behind the finished joint surface and 2 inches behind the finished joint surface in 3/8-inch-thick layers to provide a uniform substrate for final masonry pointing. Fill final 3/4-inch depth of joint continuously and uniformly in 1/4-inch-thick layers.

- c. Firmly iron each layer to compact mortar and ensure full bond between mortar and masonry units and a firm, solid joint.
  - d. Allow each layer to reach thumbprint hardness before applying succeeding layer. Do not let previous layer dry out before applying succeeding layer. Construct uniform joints.
  - e. Do not spread mortar over edges onto exposed surfaces of masonry units. Do not featheredge mortar.
  - f. When stopping work at end of each day or for other reasons, stagger layers of mortar so that there will be no through joints in mortar inserted into joints. Stagger joints in layers so that they are at least 3 inches from each other.
  - g. Where applying new work to that of a prior day, dampen previous work to ensure good bond.
3. Tooling Joints: After final layer of mortar is "leather hard," tool joints with a flat rule jointer, or as directed by Architect.
    - a. Profile: Tool joints to profile as shown on Drawings or to match original joint profiles as directed by Architect. Solidly compress mortar so that it adheres well to masonry on both sides and forms a dense surface. Premature or late tooling will result in unacceptable finishes, which will be rejected.
4. Curing
    - a. Keep newly pointed joints damp for at least 72 hours after mortar has been inserted. Do not apply a direct stream of water to joints for at least 7 days after mortar has been placed.
    - b. Ensure masonry temperature remains as required by specifications until mortar is thoroughly cured.
- C. Cleaning and Repairing Mortar Joints

1. Water Washing: Wash pointed masonry with clean filtered water and nonabrasive hand tools to remove mortar debris from masonry surfaces. Do not use chemical cleaners.
    - a. Wash within 72 hours following completion of masonry pointing.
    - b. Use blunt-edged wood scrapers, soft natural bristle brushes, and rough towels along with water to remove mortar debris. Do not use wire brushes. Do not scratch joint surfaces.
    - c. Stop cleaning masonry unit surfaces free of misapplied mortar if methods and materials used damage pointed joints. Do not resume cleaning masonry free of misapplied mortar until methods and materials have been changed to avoid damaging mortar in joints.
  
  2. Repairing Pointed Joints: As cleaning progresses, examine joints to locate cracks, holes, and other defects. Carefully point up and fill such defects with mortar. Where joints are defective in opinion of Architect cut out joints to minimum depth of 3/4 inch or two-and-one-half times joint width, whichever is greater, properly prepare joint substrates, and provide new pointing mortar exercising extreme care to ensure that color matches that of adjacent masonry pointing work. Exposed joint surfaces shall be free from protruding mortar, holes, pits, depressions, and other defects.
  
  - D. Correcting Unacceptable Joints: Should a crack occur in any joint surface, should mortar separate from a masonry unit, indicating that it did not form a strong mechanical and chemical bond with the unit, or should Architect determine that for another reason masonry pointing work does not equal or exceed the minimum standard established by the approved mock-up and comply with requirements of this Section, remove mortar to a minimum depth of 3/4 inch, properly prepare joint substrates, and repoint following requirements of this Section to Architect's satisfaction at no additional cost to Owner. At completion of work of this Section, joints shall be full of mortar soundly adhered to surfaces of masonry units at sides of joints and without defects.
- 3.17 ST3 - Stone Patch Repair
- A. General: Remove deteriorated stone to sound stone, prepare substrate, and provide new patches to provide stone units of original configuration with patches matching profile, color, and texture of stone units into which they are inserted.
    1. Existing Patches to Be Replaced: As indicated on Drawings, remove existing patches, prepare substrate, and provide new patches to match adjacent stone as specified herein.
    2. Open Lewis Holes: Clean holes free of debris and contaminants to clean, sound stone, prepare substrate, and patch as specified herein.
  
  - B. Removal of Material
    1. Remove to Sound Stone: Remove deteriorated stone to minimum depth necessary to reach sound material or substrate. Remove sound material to a depth of at least 1/2 inch behind finished surface of patch to provide for a minimum patch depth of

- 1/2 inch. Do not damage or disturb sound masonry further than 1/2 inch below the surface. Do not chip edges of masonry units.
2. Edges: Cut edges of areas where stone has been removed straight and parallel or perpendicular to joints in facade.
  3. Dovetail Mechanical Bond: Where surface of damaged stone is greater than 1/2 inch behind plane of adjacent block, slightly undercut edges of area to be patched to provide a slight dovetail.
- C. Additional Mechanical Bond for Patches over 2 Inches Deep: Where the surface of sound stone is more than 2 inches below plane of facade, provide threaded rod anchors for mechanical bond of composite patching mortar.
1. Drilling Anchor Holes: Drill holes 1 inch deep by 1/8 inch larger in diameter than threaded rods, 2 inches on center horizontally and vertically. Drill holes at slightly varying angles within 10 degrees of perpendicular to facade plane.
  2. Cleaning Anchor Holes: Clean anchor holes using stiff bristle brushes as recommended by adhesive manufacturer followed by blowing with clean, oil-free compressed air.
  3. Installing Threaded Rods: Anchor threaded rods in holes using epoxy adhesive. Rods should extend to a point 1 inch behind finished surface of patch.
- D. Preparation
1. Cleaning: Clean surfaces to be patched and filled so that they are free from dust, dirt, oils, grease, and other substances and coatings that might adversely affect adhesion of filling and patching material. Brush surfaces with stiff fiber-bristle brushes and blow clean with clean, oil-free compressed air to make certain that loose materials have been removed. Wash surfaces of prepared stone with clean water and specified detergent. Rinse thoroughly with clean, clear water and soft, natural fiber bristle brushes.
  2. Protection: Protect surrounding surfaces as necessary to prevent contact with patching materials.
  3. Wetting: Wet surface of prepared stone with clean water and soft fiber-bristle brushes to ensure that at time of patching vertical surfaces are glistening wet and horizontal surfaces are dampened without pooling water. If surfaces dry out before applying cementitious patching mortar, repeat the wetting process.
- E. Application of Patching Mortar: Prepare and apply patching mortar in strict accordance with manufacturer's directions.
1. Application of "Peanut Butter" Coat: Apply patching mortar mixed with water to the consistency of wet putty to the wet substrate to a thickness of approximately 1/8 inch. Do not allow "Peanut Butter" coat to dry out before applying patching mortar of standard consistency with water content as recommended by manufacturer.

2. Application of Patching Material: Apply patching mortar to fill voids. Trowel mortar onto wet "peanut butter" coat. Fill entire void in one steady lift, building material up slightly beyond the plane of the adjacent surfaces. Compress material as it is installed to ensure entire void is filled without gaps.
  - F. Finishing: After initial set (dependant on wind, temperature, and humidity) scrape away excess mortar to provide the appropriate profile matching adjacent planes and profiles. Finish surface to match adjacent surface.
  - G. Cleaning: Remove uncured patching mortar from the perimeter of the repair area before it dries using methods that provide uniformly clean surfaces without streaks or stains and without damage or deterioration to stone surfaces or to cementitious patching mortar patches.
  - H. Curing: Periodically mist cementitious patching mortar gently using clean water at intervals determined in accordance with the manufacturer's written instructions but at least several times a day for a period of at least 72 hours following installation. Begin misting at appropriate time depending on temperature, humidity, and wind conditions as recommended by manufacturer. Should access to the repairs be impossible over a period of time, plastic may be used to cover them temporarily. The application of plastic, however, does not remove the need for normal curing techniques.
  - I. Corrective Measures
    1. Unacceptable Conditions: Patches exhibiting cracks in patch surface, separation at sides of crack, and/or debonded areas (hollow to sounding test) shall be considered unacceptable. Remove unacceptable patches, properly prepare substrates, and provide new patches to comply with the requirements of this Section as directed by and to the satisfaction of the Architect at no additional cost to Owner.
    2. Rejected Work: Should Architect determine that any of the work does not equal or exceed minimum standard established by approved mock-up, Contractor shall cut out patch and reapply following requirements of this Section to Architect's satisfaction at no additional cost to Owner.
- 3.18 ST4 - Stone Dutchman Repair
- A. General: Remove existing damaged and deteriorated stone from stone units. Prepare holes and provide stone dutchmen matching adjacent stone to restore unit to original configuration and appearance as indicated on Drawings.
    1. In locations indicated on Drawings, remove existing dutchman, prepare substrate, and provide new dutchman.
  - B. Anchors

1. Secure each dutchman using at least two metal attachments with one additional attachment for every two additional square feet of configuration and location as shown on approved shop drawings.
  2. Attach anchors using epoxy adhesive and mechanical fastening.
- C. General Method for Dutchman Repair
1. Stone Preparation: Cut away portions of deteriorated or damaged stone and edges of losses in stone to sound stone. Cut sides of area to receive dutchman parallel to edges of stone block. Cut sides perpendicular to stone face. Do not weaken stone.
  2. Attachment: Fasten dutchman with stainless steel wire, pins, and anchors as necessary to provide mechanical locking and to prevent possible slippage of stone and as shown on approved shop drawings. Position metal anchors without weakening stone in any way.
  3. Dutchman Preparation: Dress stone dutchman on all sides and carefully fit to opening in stone, with an allowance of not more than 1/16-inch-wide buttered joints at face. Dress surface of dutchman to match appearance, tooling, and texture of adjacent stone using an approved method. Complete surface dressing of dutchman before installing dutchman.
  4. Cleaning Anchor Holes and Substrate: Use stiff bristle brushes and filtered, oil-free compressed air to thoroughly remove dust and debris from anchor holes and from stone surfaces to receive mortar.
  5. Wetting Stone Surfaces: Wet surfaces to receive mortar to ensure that surfaces are damp but free of standing water at time of mortar application (saturated, surface dry) unless specifically instructed otherwise by mortar admixture manufacturer.
  6. Installation: Install dutchman using specified mortar matching adjacent stone. Install anchors with specified adhesive.
  7. Joint Surfaces: Finish joints between new and old work to match color and texture of stone.
  8. Protection: Protect adjacent surfaces during dutchman repair. Wipe and rinse mortar accidentally splashed onto adjacent surfaces immediately.
    - a. Repair damage to stone and damage to other materials to remain resulting from adhesive and mortar spills to Architect's satisfaction at no additional cost.
  9. Cleaning: Clean faces of patched stone units following completion of dutchman installation. Clean mortar splashes, smears, etc. with wood scrapers or by vigorously brushing with stiff fiber bristle brushes and clean, potable water. If necessary to remove mortar, add clean white sand to water.

3.19 ST5 - Ferrous Element Removal

- A. General: Remove abandoned anchors and anchors from elements being removed from stone units and patch holes with composite patching mortar to match adjacent stone.
  - 1. If anchor extends across a joint between masonry units, do not patch across joint. Patch masonry units on each side of joint separately. Point joint as specified in requirements of Paragraph "Joint Preparation for Joints Containing Mortar," above."
- B. Removing Anchors: Carefully remove anchors by drilling with a rotary drill using a sharp masonry bit or masonry core bit 1/8 inch larger in diameter than existing hole. Do not chip edges of drill hole or otherwise damage adjacent masonry. Do not use hammer drill or other percussive power tools.
- C. Patching Using Composite Patching Mortar: Prepare and patch holes as specified in Article "Patching Stone Units Using Composite Patching Mortar," above.

3.20 ST6 - Non-structural Crack Repair

- A. General: Prepare and inject cracks with cementitious grout. Rout out cracks at surface and fill with custom patching mortar to match color and texture of adjacent stone surface.
- B. Preparation: Drill 1/4-inch-diameter injection ports into crack approximately 6 inches on center. Remove dust, dirt, loose particles, and other contaminants that might adversely affect adhesion of grout or durability of grout from crack using mechanical means followed by clean, oil-free compressed air and a test tube brush. Install injection ports over holes. Seal surface of crack and adhere injection ports to stone with temporary crack sealer. Protect adjacent masonry surfaces from contact with grout using approved methods.
- C. Prewetting Substrates: Immediately before injecting grout, flush crack with clean water. If grout is not installed immediately, flush crack again with water to ensure that stone surfaces at sides of crack are wet at time of grout injection.
- D. Injection of Grout: Inject cementitious grout using gravity flow or other approved equipment and methods to ensure that crack is filled as approved by Architect.
- E. Preparation for Patching Crack at Surface: Remove temporary sealer and injection ports and clean stone surface. Rout out cracks to a depth of 5/8 inch and a width of 1/8 inch. Remove grout from front 5/8-inch depth of injection ports exposing clean stone surface. Do not damage adjacent stone surfaces.
- F. Cleaning: Clean stone at sides and rear of routed cracks and at injection ports thoroughly using fine, stiff fiber-bristle brush followed by clean, oil-free compressed air to remove particles and dust.



- G. Wetting: Thoroughly rinse surfaces to ensure that substrate will not rapidly absorb water from patching mortar.
- H. Application of Patching Mortar: Brush stone substrates with a mortar slurry coat and fill holes with specified composite patching mortar matching color of adjacent cleaned stone following manufacturer's directions. Fill crack to minimum depth of 2 ½ times the crack width.
- I. Finishing: Strike surface of repaired crack flush with face of adjacent stone. Finish surface of filled crack to match texture and finish of adjacent cleaned stone.
- J. Curing: Protect installed mortar from too rapid drying and from contact with water that might wash binder from surface.

### 3.21 ST7 - Structural Crack Repair

- A. General: Pin broken pieces of stone to sound pieces of stone and pin loose stone units to sound stone units or to sound backup masonry as indicated on Drawings and inject cracks with epoxy adhesive.
- B. Drilling: Drill holes in loose stone units and in cracked stone units indicated to be pinned using rotary drill with sharp masonry bit. Do not use hammer drill or other percussive tools. Extend holes at least 3 inches into solid masonry backup or into solid and securely anchored adjacent portion of stone unit.
- C. Cleaning Holes: Use specified stiff bristle brushes and filtered, oil-free compressed air applied through specially designed nozzles to thoroughly remove dust and debris from holes to receive pins.
- D. Protection of Substrate to Be Patched: Protect outer portions of stone surface within holes to receive composite patches using masking tape or other means to prevent contact with adhesive.
- E. Pinning: Inject epoxy adhesive and insert threaded dowels, pushing until dowel ends are below stone surface to extent shown on Drawings but not less than 1/2 inch. Recess head of anchor 1" minimum from exposed stone.
- F. Patching Holes: Patch holes in exposed surfaces using composite patching mortar following requirements of Article "Patching Stone Units Using Composite Patching Mortar," above. Patches shall match color, texture, and surface of adjacent stone. Cure patches to comply with composite patching mortar manufacturer's recommendations to ensure optimum performance of patching mortar.
- G. Injecting Cracks with Epoxy Adhesive: Fill cracks by injecting epoxy adhesive as follows:
  - 1. General: Prepare cracks and inject cracks with epoxy adhesive. If width of crack at surface is not greater than 1/32 inch, drill out front portions of injection ports and fill with custom patching mortar to match color and texture of adjacent stone

surface. If width of crack at surface is greater than 1/32 inch, drill out front portions of injection ports and rout out cracks at surface and fill with custom patching mortar to match color and texture of adjacent stone surfaces.

2. Preparation: Drill 1/4-inch-diameter injection ports into crack approximately 6 inches on center. Remove dust, dirt, and loose particles from crack using mechanical means followed by clean, oil-free compressed air. Install injection ports over holes. Seal surface of crack and adhere injection ports to stone with temporary crack sealer. Protect adjacent stone from contact with epoxy adhesive using approved methods.
3. Epoxy Injection: Match viscosity of epoxy to width of crack so that crack will be completely filled. Inject epoxy using specified equipment and methods to ensure that crack is filled as approved by Architect.
4. Preparing Injection Ports at Cracks Not Exceeding 1/32-Inch in Width: At cracks not exceeding 1/32-inch in width, drill out surface of injection ports to a depth of 5/8 inch to remove adhesive and provide sound, clean stone substrate. Do not damage adjacent stone surface.
5. Preparing Stone Surface at Cracks Exceeding 1/32-Inch in Width: At cracks exceeding 1/32-inch in width, drill out surface of injection ports to a depth of 5/8 inch and rout out surface of crack to a width of 1/8 inch and a depth of 5/8 inch to remove adhesive and provide sound, clean stone substrate. Do not damage adjacent stone surface.
6. Cleaning: Clean stone at injection ports and at sides and rear of routed cracks thoroughly using fine, stiff, fiber-bristle brush followed by clean, oil-free compressed air to remove particles and dust.
7. Wetting: Thoroughly rinse surfaces to ensure that substrate will not rapidly absorb water from patching mortar.
8. Application of Patching Mortar: Brush stone substrates with a mortar slurry coat. Fill injection ports and/or cracks fill with specified composite patching mortar matching color of adjacent cleaned stone.
9. Finishing: Strike surfaces of repaired crack and injection ports flush with face of adjacent stone. Finish surfaces of filled crack and injection ports to match texture and finish of adjacent cleaned stone.
10. Curing: Protect installed mortar from too rapid drying and from contact with water that might wash binder from surface.

### 3.22 ST8 - Loose Material Removal

- A. General: Retool stone surfaces to remove flaking and deteriorated stone and to provide new tooled surfaces matching existing adjacent stone surfaces to meet the standard of approved mock-ups.

- B. Removal: Remove flaking stone to sound stone surface, and remove previous patches as indicated. Do not remove sound stone.
- C. Tooling: Using chisels, gently tool scaled stone surfaces. Use minimum amount of tooling to achieve sound surface with same tooling pattern as on original stone surface and matching adjacent stone surface.

3.23 ST10 - Stucco Repair

- A. Carefully remove damaged material down to substrate. Protect existing brick masonry substrate to remain.
- B. Provide 3-coat stucco matching thickness of existing layers, approximately 1-1/4" thick total.
- C. Install replacement stucco to sound material only.
  - 1. Base/Scratch Coat: Install directly to brick masonry substrate. Spread evenly with hawk and trowel. Scarify surface.
  - 2. Brown Coat: Provide even and uniform surface using a darby or long trowel.
  - 3. Top/Finish Coat: Provide textured surface to match existing surfaces using a hawk and trowel.
  - 4. Finished surface: Apply finishing stain to match color of existing surfaces.

3.24 ST11 – Stone Replacement

- A. General: Install salvaged stone units in their original locations as indicated on Drawings. Do not damage stone units. Repair and replace stone units damaged during work of this Section as directed by Architect and to Architect's satisfaction at no additional cost to Owner.
- B. Cleaning Stone: Clean stone before setting. Remove old mortar from salvaged stone and scrub stone with detergent and water using natural or synthetic fiber bristle brushes. Thoroughly rinse salvaged stone and new stone with clean water.
- C. Anchor Holes: Where indicated on Drawings, necessitated by conditions at site, and as shown on approved shop drawings, drill new holes and mortises to receive anchors, cramps, dowels, and other attachment elements. Use rotary drills, masonry saws, and other methods that do not damage stone. Do not use hammer drills or other percussive tools.
- D. Cleaning Holes: Use stiff bristle brushes and filtered, oil-free compressed air to thoroughly remove dust and debris from holes to receive pins. Brush surfaces at sides of holes vigorously and blow free of contaminants.

- E. Setting: Set salvaged stone units accurately with new stainless steel threaded rods, seismic anchors, continuous stainless steel wire, and fresh mortar to match condition of original masonry as shown on the Drawings. Set true to line and level and fill joints and anchor holes completely with mortar.
1. Joint Widths: Set stone units with joints of uniform width not exceeding width of existing joints.
  2. Set stones such that their weight is supported by shims, not the mortar bed. In bed joint (horizontal joint), use two shims per stone, approximately at midpoint of width and quarter points of length. Recess shims at least 1 in. from the face of stone to permit adequate mortar coverage. Ensure that the stone is fully bedded in mortar.
  3. Lay bed mortar and immediately set stone to prevent drying out of mortar. Do not furrow bed joints. Completely butter the ends of each stone with mortar and shove the stone into place so that mortar squeezes out of the top of the head joint and bed joint. Rake out mortar to a depth of 5/8 in. from the exterior face of the stone to accommodate final pointing.
- F. Defects: Patching of defects in stone blocks shall not be permitted. Redress stone units with chips on faces and clean stone units with stains on faces. No acid-leaching agent shall be permitted.
- G. Preparation for Pointing: Upon completion of setting stonework, rake joints to prepare them for pointing in compliance with Article "Repointing and Deep Repointing Joints," below.

End of Section

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SECTION 05 12 00  
STRUCTURAL STEEL FRAMING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Furnish and deliver for installation by others, anchor bolts and bearing plates with complete instructions and templates to facilitate installation.
2. Furnish and erect all struts, columns, bearing plates, beams, girders, bracing, hangers and all related connections (bolted and welded).
3. Openings and notches (unreinforced and reinforced) in new and existing structural steel to accommodate mechanical and electrical work.
4. Shop painting and field touch-up painting.
5. Erection bracing and supports, including steel wedges, shims or nuts required for leveling base plates.
6. Lintels and angles attached to structural steel as shown on drawings.
7. Unless specifically excluded, furnish and install all other items for structural steel work indicated on the drawings, specified, or obviously needed to make the work of this Section complete.
8. Waste Management

- B. Related Requirements:

1. Division 01 "Construction Waste Management Plan"
2. Division 01 "Sustainable Design Requirements"
3. Division 03 Section "Cast in Place Concrete"
4. Division 05 Section "Metal Deck."

- C. Related Work Specified Elsewhere

1. Installation of anchor bolts furnished under this section.
2. Grout under base and bearing plates.
3. Installation of loose lintels furnished under this section.
4. Miscellaneous metal work
5. Stair framing and hangers.
6. Field painting of structural steel, except as specified herein.
7. Fireproofing systems.

### 1.3 SUSTAINABLE DESIGN REQUIREMENTS

- A. The Contractor is to implement practices and procedures to meet the Project's Sustainable Design goals, which include achieving LEED v4 Silver. The Contractor shall ensure that the requirements related to these goals, as defined in this Section and in Related Sections of the Contract Documents, are implemented. Substitutions, or other changes to the Work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the Project's Sustainable Design goals.
- B. Related Sections: Following description of work is included for reference only and shall not be presumed to be complete:
1. Provision of waste management: Section 017419, Construction Waste Management Plan.
  2. Provision of general LEED requirements and forms: 018113 Sustainable Design Requirements.
- C. The Contractor is to efficiently use resources and energy while executing the Work of this Section. Resource efficient aspects to be considered in completing this Project include the use of techniques that minimize waste generation, reuse of construction materials on site where possible, and recycling of waste generated during the construction process.
- D. Performance Requirements: The following criteria are required for the products included in this section
1. Preference shall be given to materials within 500 miles of the project site, and those steel components originating from mills/fabricators located nearest to the building site.
  2. All steel shall contain a minimum of 50% (combined) pre-consumer/post-consumer recycled content.
  3. Adhesives, sealants, paints and coatings used for the work of this section shall meet the Volatile Organic Compound (VOC) limits specified in Section 018113 "Sustainable Design Requirements," and below where applicable.
  4. Maximize the re-use of salvaged steel (as approved by the Engineer of Record) and, for work on existing buildings, alert the design team to any existing steel which could be re-used but has not been indicated on the drawings.
  5. Maximize the recycled content of all steel products.
  6. Design details penetrating the façade strictly in accordance with the architectural and structural directives.
  7. Where possible all connections should be made using bolted as opposed to welded details.
  8. Where welding is required use Submerged Arc Welding (SAW). The Gas Metal Arc Welding (GMAW) shall be used were SAW is not applicable (such as for angled connections and anything irregular or short). Field welding shall be allowed only in special circumstances; in such cases Flux Core Arc welding (FCAW) shall be specified with the use of portable fume exhaust system.
  9. Use high strength HSS round tubes instead of A36 Steel pipes with approval of the Engineer of Record.

#### 1.4 LEED SUBMITTALS

- A. Submit LEED Certification as follows:
  - 1. Provide manufacturer's product documentation for each product having an Environmental Product Declaration (EPD).
  - 2. Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- B. Recycled Content
  - 1. Provide manufacturer's product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
  - 2. Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
- C. Provide manufacturer's or third-party certification of testing to and compliance with the California Department of Public Health (CPDH) Standard method v1.2-2017.
- D. Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
- E. Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.
- F. Letters of Certification: Provided by the manufacturer on the manufacturer's letterhead, verifying the amount of recycled content.
- G. Product Cut Sheets: For all materials that meet the sustainable design performance criteria as per the LEED Performance Requirements of this section.
- H. Material Safety Data Sheets (MSDS): For all applicable products. Applicable products include, but are not limited to, adhesives, sealants, paints, and coatings applied to the interior of the building. MSDS shall indicate the Volatile Organic Compound (VOC) content of products submitted. If an MSDS does not indicate VOC content, then product data sheets, manufacturer's literature, or certification letter indicating a product's VOC content can be submitted with the MSDS.
- I. Assemble required LEED Submittal information into one (1) package for each Specification Section or sub-contractor. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submittal products or assemblies.

#### 1.5 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

## 1.6 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of all connections required by the drawings to be completed by structural steel fabricator (including comprehensive engineering analysis by a qualified professional engineer) to withstand loads indicated and comply with other information and restrictions indicated, unless noted otherwise.
  - 1. Select and complete connections using schematic details indicated and AISC 360.
  - 2. Use design method indicated on structural drawings.
  - 3. Moment Connections: Fully restrained unless otherwise noted on drawings.
- B. Lateral Framing Resisting System: Type used is indicated on structural drawings.

## 1.7 SUBMITTALS

- A. Product Data: Submit data for each type of product indicated in the contract documents.
- B. Shop Drawings: Submit shop drawings in accordance with the specifications as follows:
  - 1. Show clearly all work, including relationship of structural steel to the adjacent work of other trades and to significant lines of finishes of other trades.
  - 2. Do not fabricate or deliver work to the site before drawings reviewed by the Architect and Engineer of Record have been returned.
  - 3. Before preparing steel shop drawings, submit proposed submittal schedule for review by Architect and Engineer of Record.
  - 4. Before preparing steel shop drawings, submit for review a set of job standards showing all necessary joint details with full particulars of connection pieces, shop and field welds, and holes for erection bolts and permanent bolts. These shall include any moment and shear connections. Appropriate marks for designating all types and sizes of joint details shall be included. After approval of these job standards, the erection plans are to be submitted and shall be marked to indicate unmistakably the type and size of joint to be used for every beam connection. Do not order steel in advance of approval of the job standards and the erection plans with joint marks, except at own risk
  - 5. Submit calculations for design of connections on job standards and all other connections such as moment and brace frames. Calculations shall be signed and sealed by a Professional Engineer licensed in the state in which the project is located.
  - 6. Prepare remainder of steel shop drawings after approval of job standards and erection plans. Drawings submitted prior to approval of job standards will be returned without review.
  - 7. Prepare shop drawings in conformance with the applicable procedures shown in "*Detailing for Steel Construction*," latest edition, published by AISC. Prepare shop drawings under the supervision of competent engineering personnel, licensed by the state in which the construction is to take place. During the preparation of shop



- drawings, and prior to submittal, coordinate and cross check all shop drawings, including those prepared by subcontractors, for compliance with the Contract Documents.
8. Indicate clearly the size and grade of steel for each component. Identify rolled shapes, tubes and plates by using the standard designations used in "Steel Construction Manual" Latest Edition, by AISC.
  9. Indicate welds and nondestructive tests by using the symbols conforming to AWS A2.4 "Symbols for Welding and Nondestructive Testing." Where necessary for clarity, indicate welding procedure designations or other data in the tail of the welding symbol.
  10. Show explicitly the type of connection used in each location, including the grade, size, and number of bolts; the type, number, position, designation and orientation of each washer; and the size of each hole, whether slotted or round. Ensure that adequate wrench clearance for correct bolt tightening is provided and note special bolt tightening sequences where applicable and necessary.
  11. Show all camber dimensions in the shop drawings. Where specific camber is not shown in the drawings, note on each affected shop drawing that such members are to be fabricated with the natural camber up.
  12. Show holes required for securing work specified in other sections to structural steelwork, as well as all holes required for passage through structural steelwork of work of other trades. Provide field work drawings for all such holes not shown in shop or erection drawings. Addition of, or change in size or location of openings will not be permitted without prior approval.
  13. Show all penetrations, openings, and notches in new and existing steel, including reinforcement, length, width, elevation within beam, and location along length of beam.
  14. Use bolted connections wherever possible; avoid field welding unless otherwise noted on drawings.
  15. Make details in such a way as to avoid having steel, connections, bracing, bolts, etc., interfere with architectural details or in any way reduce the areas of shafts, openings, clearances, etc.
  16. Detail and schedule cleaning and painting data and requirements, including specific indication of "no-paint" areas.
  17. The use of the Architect's or Engineer of Record's electronic drawing files as a base for the erection shop drawings will be permitted at the request of the structural steel detailer upon completion and return of the waiver form. The use of the Architect's or Engineer of Record's electronic drawing files as a base for shop drawing details will not be permitted. The structural steel detailer will be responsible for compatibility of the files with his hardware or software. The electronic files are not to be considered the contract documents, the design team makes no representation regarding the accuracy or completeness of the electronic files given to the structural steel detailer and their use will be at the structural steel detailer's sole risk and without liability to the design team. The structural steel detailer shall remove the project title box and all references to the structural drawings including drawing numbers and structural drawing sections and details. The structural steel detailer shall also remove all reference to work not included in the steel contract.
  18. Scaling of the Architect's or Engineer of Record's drawings is not permitted. This applies to hard paper, electronic, and all other versions.
  19. Show clearly the size and location of each member and the erection mark assigned to each member. Show each field connection with all data and details necessary

- for assembling the structure. Direct special attention to the possible need for special guying, bracing, or shoring to prevent deformation of existing or new structure due to stresses caused by erection procedures and equipment, by construction loadings, and by forces of natural phenomena.
20. Prepare, keep up-to-date, and submit a complete drawing index cross-referencing each assigned piece mark with the drawing number in which the piece is detailed. Detail drawings submitted without an up-to-date index and the applicable erection drawing(s) showing the location of each piece will be deemed an incomplete submission and will not be accepted as subject to any agreed shop drawing review schedule.
  21. Prepare anchor bolt and base plate erection drawings containing complete location and placing details, including details of all templates. Provide anchor bolt erection drawings to the concrete trade in advance of applicable concrete work and in coordination with concrete construction sequence.
  22. Submit, in writing, any proposed deviations from the Contract Documents, prior to the submission of shop drawings showing the proposed deviation. Submit requests for deviations on the steelwork subcontractor's letterhead. Deviations not identified, or identified only in letters of transmittal or in shop drawings or both, without the required written request, may not be accepted, and shall be sufficient cause for the architect to return each shop drawing containing such deviations without further action. Acceptance of shop drawings containing deviations not detected by the architect during shop drawing review shall not relieve the steelwork subcontractor from responsibility to conform strictly to the Contract Documents.
  23. Prior to resubmission of shop drawings with additions or corrections, circle or bubble and identify all changes. Drawings submitted without each change being clearly identified are subject to return for resubmission.
  24. Prior to making shop drawings for any portion of the work involving alterations to an existing structure, make all necessary field observations, measurements and surveys of existing conditions. If probes are required to accomplish such measurements, give timely notice where probes will be required.
- C. Submit certified copies of each survey conducted by a surveyor licensed by the state in which the construction is to take place and employed by the structural steel subcontractor. Survey shall show elevations and locations of base plates and anchor bolts to receive structural steel, and final elevations and locations for major members. Indicate discrepancies between actual installation and Contract Documents.
- D. Reports:
1. Submit certified copies of mill test reports for all steel furnished. Perform mechanical and chemical tests for all material regardless of thickness or use.
  2. Submit certification of recycled steel content. Certification shall clearly indicate post-consumer AND post-industrial recycled steel content for the particular member or members used.
  3. Submit anchor bolt checking certification as required.
  4. Submit qualification certificates of all welders who will perform work on the project.
  5. Submit survey of erected steelwork as required.
- E. Submit verification of bio-degradable or low VOC, and low Hazardous Air Pollutants (HAPS) cleaning solutions. Provide a cut sheet for all cleaning solutions used in the surface preparation of steel components. Highlight VOC limits and chemical component

limits.

## 1.8 QUALITY ASSURANCE

A. Except as modified by this specification, comply with the applicable provisions and recommendations of the following codes and standards:

1. New York State Building Code, 2020
2. AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings".
3. AISC "Code of Standard Practice for Steel Buildings and Bridges" latest edition.
4. AISC "Seismic Provisions for Structural Steel Buildings", latest edition.
5. Industrial Fasteners Institute "Handbook of Bolt and Bolted Joints" latest edition.
6. RCSC "Specifications for Structural Joints Using High-Strength Bolts."
7. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.
8. AWS D1.1, "Structural Welding Code."
9. AWS A5.18 & A5.28, Structural Welding Code for GMAW
10. SSPC "Painting Manual, Volume 2, Systems and Specifications.", Latest edition.

B. Qualifications for welding work shall be as follows:

1. Qualify welding procedures and welding operators in accordance with the AWS "Standard Qualification Procedure."
  - a. Include amended requirements of the building code as noted above.
2. Submit certification that all welders to be employed in work are AWS qualified. If re-certification of welders is required, retesting will be responsibility of structural steel subcontractor.
  - a. Include licensing requirements as per the building code noted above and local jurisdiction.

## 1.9 TESTING AND INSPECTION

A. Special Inspection as required by the applicable Building Code of all structural steelwork in the shop and field will be performed by an inspection agency retained by the Owner at no expense to the Contractor. The inspection agency shall work under the direction of the Owner. Contractor shall provide the inspection agency with the following:

1. Schedule of all work in both shop and field with at least ten days' written notice before commencement of either activity.
2. A complete set of approved shop and erection drawings.
3. Cutting lists, order sheets, material bills, shipping bills and mill test reports.
4. Information as to time and place of all rollings and shipment of material to shops.
5. Representative sample pieces as requested by the testing agency.
6. Full and ample means and assistance for testing all material.
7. Proper facilities, including scaffolding, temporary work platforms, etc., for

inspection of the work in the mills, shop and field.

- B. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person making the connection.
- C. The following minimum criteria shall be adhered to in testing of welds and bolts:
1. All welds and bolts shall be examined by visual means.
  2. 25% of all welds, selected randomly, shall be measured.
  3. Bolted joints shall be verified per the RCSC "Specification for Structural Joints Using High-Strength Bolts," Section 9, based on installation method.
  4. All welds subject to tensile stress shall be examined by the Ultrasonic Method for 100% of their length.
  5. 10% of all manual fillet welds shall be tested by the magnetic particle method.
  6. 1'-0" at each end of automatic fillet welds shall be tested by the magnetic particle method.
  7. 100% of groove welds shall be tested by the ultrasonic method.
- D. Shop inspection will include examination of steel for straightness and alignment, fissures, mill scale, and other defects and deformities, as described in ASTM A6, examination of fabricated pieces for conforming to approved shop drawings, testing of bolts and welds, and inspection of shop painting. All shop welds shall be visually inspected and spot tested using Ultrasonic Method ASTM E 114 and AWS, Chapter 6, Part C. All inspected welds shall be identified by the inspector.
- E. Field inspection will include examination of erected steel for welding, proper fitting and tensioning of bolts, alignment, trueness and plumbness, touching-up of shop coat, level of billets and base plates.
- F. Inspection of welding will be such as to assure that the work is within the quality requirements specified below and elsewhere in this section of the specifications and will include:
1. Ascertainment that the electrodes and flux used for the SAW, GMAW and FCAW welding processes conform to the requirements of this section of the specifications.
  2. Ascertainment that the approved welding procedures and sequence are followed without deviation, unless specific approval for change is obtained from the Engineer of Record.
  3. The testing agency shall be prepared to utilize the following approved methods of testing:
    - a. Liquid penetrant inspection: ASTM E 165.
    - b. Magnetic particle: ASTM E 1444.
    - c. Radiographic inspection: ASTM E 94 and E 1032.
    - d. Ultrasonic inspection: ASTM E 114 and AWS, Chapter 6, Section C.
- G. When defects are revealed, additional inspection by whatever method is deemed necessary by the inspector, shall be performed to the extent necessary to assure that the full amount of defect has been located. No further work shall be done on the assembly or sub-assembly in question until all the necessary corrections have been

made. Defects shall be repaired, using the same welding procedure that was used initially in making the weld, unless otherwise approved by the Engineer of Record. Inspection of the repaired weld shall be by the same method that was used to reveal the defect. A second repair of a defective area shall not be made without approval of the Engineer of Record.

- H. Apparatus and procedures for measuring required tension in pretensioned and slip-critical high strength bolted connections shall be furnished and maintained by the steel contractor, in accordance with the RCSC "Specification for Structural Joints Using High-Strength Bolts," and shall be approved by the inspection agency. The inspection agency shall observe the pre-installation verification testing required and shall ensure by routine observation that the bolted installations conform to the approved pretensioning method being used. The steel contractor shall provide a laborer and scaffolding as required for the testing of connections by the inspection agency, and shall, at his own expense, furnish such facilities and provide such assistance as may be required for proper inspection.
- I. A distinguishing mark will be placed on all work that has been inspected and approved. Material or work that is not acceptable will be designated by words such as "REJECT" or "REPAIR" marked directly on the material or work.
- J. Inspection of Shop Painting:
  - 1. Visually evaluate surface preparation by comparison with pictorial standards in accordance with SSPC-Vis 1.
  - 2. Measure dry film thickness of each coat with a magnetic film thickness gauge in accordance with SSPC-PA 2.
  - 3. Visually inspect dried film for runs, sags, dry spray, overspray and missed areas.
  - 4. Repair defective or damaged areas in accordance with painting requirements specified. Architecturally exposed structural steel shall be free of runs and holidays. Make repairs to shop or field coat as directed.

#### 1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work. Minimize the disturbances to site and soil conditions.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members in a safe, dry, off ground location, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration, discoloration or staining.
- D. Do not store materials on structure in a manner that might cause distortion or damage to members of supporting structures. Repair or replace damaged materials or structures as directed.

#### 1.11 PROJECT CONDITIONS

- A. The structural steel contractor shall coordinate the structural steel work with the work of other Contracts. Verify all dimensions and details of this Contract and those of other Contracts that affect the work before proceeding. Any discrepancies shall be immediately reported to the architect.
- B. Be fully responsible for the accurate installation of the work. Any discrepancy which arises from his failure to execute the work in conformity to the drawings and specifications shall be properly remedied at the contractor's own expense and in a manner acceptable to the architect.
- C. Locate dimensionally on setting plans all anchor bolts, inserts, bearing and base plates, etc., and prepare and deliver all required templates and fully dimensioned setting plans in time for the proper execution of the work. Anchor bolts shall be set by another subcontractor. The structural steel contractor shall check all such settings for correctness after they have been cast in place, and before proceeding with erection work.
- D. Report to the architect and certify compliance with the above checking requirements in writing and indicate any inaccuracies found in the location of anchor bolts or inserts, and corrections which must be made to their installation. Any inaccuracies not included in the report and found during or after steel erection shall be the responsibility of the structural steel contractor and the cost of corrective measures shall be borne by the structural steel contractor.
- E. Use base lines, bench marks, or other standards for survey work that have been provided or verified by others. If permanent building bench marks have been established, these will be used for field checking.
- F. Coordinate with all other trades to insure that work of this section does not cause undue conflict. Insure that location of erection devices such as cranes, derricks, booms or hoists, does not cause over-stresses to steel frame to work previously placed by other trades or to existing structures. When required, retain the services of a licensed professional engineer to ascertain that erection devices do not create unsafe conditions or cause overstresses.
- G. Ensure full co-ordination with other related trades and professions.

#### 1.12 SUBSTITUTION

- A. Architect reserves the right to require substitute shapes of other sizes than those indicated on the drawings when it is apparent that the shapes specified cannot be furnished within the time required for the progress of construction. Make said substitutions without additional cost to the owner.

### **PART 2 - PRODUCTS**

## 2.1 MATERIALS

- A. Provide products with Third Party Environmental Product Declaration (EPD) whenever available.
- B. Provide products with recycled content of at least 60%.
- C. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- D. Steel shapes, including structural steel wide flange and structural tee rolled shapes, channels, angles, plates, pipe, and hollow structural sections: As noted on structural drawings.
- E. High Strength Bolts: As noted on Structural Drawings.
- F. Anchor Rods: As noted on structural drawings
- G. Filler metal for welding electrodes. As noted on structural drawings.
- H. Structural steel primer paint: rust inhibitive primer conforms to the following criteria
  - 1. Coordinate all paint requirements with specification section 099000.
  - 2. Demonstrate a minimum of adhesion as classified by 4B of ASTM D 3359 method A
  - 3. Demonstrate a minimum opacity as determined by ASTM D 2805
  - 4. Demonstrate corrosion resistance per standards ASTM B 117 & ASTM D 5894
  - 5. "Slip Critical" compatible rating where applicable
  - 6. The product shall not contain any of the prohibited compounds as listed in Green Seal *Standard for Paintings and Coatings*, GS-11, latest edition and in Master Painters Institute (MPI) *Green Performance Standard*, GPS-1-08.
  - 7. The product shall meet the VOC limits as set forth in the MPI Green Performance Standard, GPS-1-08, with a maximum allowable VOC of 340 g/L for rust preventative coatings. Limits are expressed in THINNED state. Preference shall be given to products with the least crystalline silica content.
  - 8. The product shall meet all the requirements of MPI Standards: 23, 26, 76, 79, 95, 107, 135, 173, 275. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category.
    - a. Exterior exposed steel, normal conditions: Use alkyd or polyamide solvent based paints (MPI #'s 76, 79 & 101)
    - b. Interior exposed steel: Use water based paint (MPI # 107)
    - c. Special Applications, highly corrosive environments: Use zinc rich paints (MPI #'s 20 & 200)
- I. Structural steel field paint for exposed members: rust inhibitive primer conforms to the following criteria
  - 1. Coordinate all paint requirements with specification section 099000.
  - 2. Demonstrate a minimum of adhesion as classified by 4B of ASTM D 3359 method A

3. Demonstrate a minimum opacity as determined by ASTM D 2805
4. Demonstrate corrosion resistance per standards ASTM B 117 & ASTM D 5894
5. "Slip Critical" compatible rating where applicable.
6. The product shall not contain any of the prohibited compounds as listed in Green Seal *Standard for Paintings and Coatings*, GS-11, latest edition and in the Master Painters Institute *Green Performance Standard*, GPS-1-08.
7. The product shall meet the VOC limits as set forth in the MPI Green Performance Standard, GPS-1-08, with a maximum allowable VOC of 400 g/L for rust preventative coatings. Limits are expressed in THINNED state. Preference shall be given to products with the least crystalline silica content.
8. The product shall meet all the requirements of MPI Standards: 23, 26, 76, 79, 95, 107, 135, 173, 275. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category.
  - a. Exterior exposed steel, normal conditions: Use alkyd or polyamide solvent based paints (MPI #'s 23, 79)
  - b. Interior exposed steel: Use water based paint (MPI # 107)

### PART 3 - EXECUTION

#### 3.1 FABRICATION

- A. All shop connections shall be high strength bolted unless specifically shown otherwise. Fabricate work in shop in as large assemblies as practicable. Use welded connections ONLY where shown on drawings. If a bolted connection is not possible, obtain written approval from the Engineer of Record for the welded connection.
- B. Camber: As indicated on drawings.
- C. Mill column ends and bearing stiffeners to give full bearing over the cross section. Plane contact surfaces of bearing plates when required by the AISC Specifications. It is not necessary to plane bottom surfaces of plates on grout beds.
- D. Drill or punch holes at right angles to the surface of the metal, not more than 1/16" larger than the connector diameter. Do not make or enlarge holes by burning. Drill material having a thickness in excess of the connector diameter and material thicker than 7/8". Holes shall be clean-cut without torn or ragged edges. Remove outside burrs resulting from drilling operations.
- E. Provide holes in members to permit connection of the work of other trades. Use suitable templates for proper location of these holes. Steel requiring adjustment or accurate alignment shall be provided with slotted holes or full bearing shims as shown.
- F. Provide holes, slots and openings required by other trades together with necessary reinforcing required. Use suitable templates for proper location of these openings. All such openings shall be shown on the shop drawings. No change in size or location will be permitted without prior approval.



- G. Manual flame cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is within 1/8" of the required line.

### 3.2 SHOP CONNECTIONS

- A. Provide connections as shown on the drawing exactly as detailed. Where connections are not detailed, the minimum connections shall comply with appropriate tables headed, "Framed Beam Connections" shown in the AISC "Manual of Steel Construction" unless otherwise noted on the drawings. Use high strength bolts unless otherwise shown.
- B. Do not use welded connections unless shown on details. Field welding is not allowed without written instruction from the Engineer of Record.
- C. Proportion and detail all connections on shop drawings to resist forces shown on design drawings.
- D. Bolting
  - 1. Bolts shall be of a length that will extend not less than 1/4" beyond the nuts. Enter bolts into holes without damaging the thread.
  - 2. Joint Type: As noted on the Structural Drawings.
  - 3. Make high-strength bolted joints without the use of erection bolts. Bolt heads and nuts shall rest squarely against the metal. Where structural members have sloping surface, bolted connections shall be provided with beveled washers to afford square seating or framing for bolt heads or nuts.
  - 4. All joints are to be compacted to the snug-tight condition in accordance with Section 8 of the RCSC "Specification for Structural Joints Using High-Strength Bolts." Protect bolt heads and threads from damage during installation.
  - 5. Pretensioned and slip-critical joints are to be installed by one of the methods prescribed in Section 8.2 of the RCSC "Specification for Structural Joints Using High-Strength Bolts," unless written approval is obtained from the Engineer of Record.
  - 6. Bolts that have been completely tightened shall be marked for identification.
- E. Welding
  - 1. The following environmentally preferable welding processes shall be used as described for the related application without exception:
    - a. Submerged Arc Welding (SAW): Plate girders, fillet and butt joints in pipes, cylinders, columns and beams, and welds where 'downhand' or horizontal positions are possible.
    - b. Gas Metal Arc Welding (GMAW) shall be used where SAW is not applicable (such as for angled connections and anything irregular or short).
    - c. Field welding shall be allowed only in special circumstances; in such cases Flux Core Arc welding (FCAW) shall be specified
  - 2. Do not begin structural welding until joint elements are inspected for surface preparation, fit-up, and cleanliness of surface to be welded and are then bolted or tacked in intimate contact and adjusted to dimensions shown on drawings, or both,

with allowance for any weld shrinkage that is expected. No members are to be spliced without prior approval by the Engineer of Record.

- a. Containment surface preparation debris must meet SSPC-Guide 6 guidelines.
3. Pre-heat and interpass temperature shall be in accordance with Table 4.2 (including footnotes) of the AWS Code for Welding in Building Construction. The temperature shall be measured from the side opposite to that which the pre-heat is applied, where possible.
4. All groove welds shall be continuous and full penetration welds unless otherwise shown on the design drawings. Welds made without the aid of a back-up bar shall have their roots chipped, ground or roughened out to sound metal from the second side, before welding is done from the second side.
5. All welds shall be sound throughout. There shall be no crack in any weld or weld pass. Weld may be considered sound if it contains only slight porosity or fusion defects which are well dispersed.
6. The heat, input, length of weld and sequence of weld shall be controlled to prevent distortions. The surfaces to be welded and the filler metals to be used shall be subject to inspection before any welding is performed.

### 3.3 SHOP PAINTING AND CLEANING

#### A. Finishing, coating, plating

1. Shop painting and factory finishing shall be preferred to field painting whenever possible. Where applicable, finishes and surface preparations based on a physical process such as abrasive blasting, grinding, buffing and polishing are preferred to coatings and solvent based cleaning. Where coatings are necessary powder-coated fabrication is preferred to painting and plating. Avoid plated metals especially those using cadmium and chromium as plate material or cyanide or copper/formaldehyde based electroless copper as the plating solution.

#### B. Remove all rust, scale, grease and other detrimental foreign matter in accordance with SSPC-SP 3, Power Tool Cleaning, unless conditions/opportunities listed below apply.

1. Use surface preparation classification recommended by paint manufacturer, SSPC or Master Painters Institute (MPI) for paint product used.
  - a. SSPC-Guide 6, Guide for Containing Debris Generated During Paint Removal Operations, must be followed for all applicable surface preparation techniques.

#### C. Immediately after surface preparation, apply structural steel primer paint where specified, in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 2.0 mils. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces. Use type of primer paint as specified in "Materials" article above. Apply two coats to surfaces that will be inaccessible after erection

- D. Paint all structural steel in accordance with the foregoing specification, except as follows:
1. Steel which is to receive spray-on fireproofing.
  2. Within 2" of field welds or welds made after paint is applied.
  3. Faying surfaces in bolted connections shall be prepared per Section 3.2 of the RCSC "Specification for Structural Joints Using High-Strength Bolts."
  4. Machined surfaces and threaded parts required for adjustment of the structure. Protect these with suitable rust inhibiting coating which may be removed after final installation of the work so that proper finished coatings may be applied.

### 3.4 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

### 3.5 SOURCE QUALITY CONTROL

- A. Refer to testing and inspection requirements specified above.

### 3.6 EXAMINATION

- A. Verify field measurements prior to start of erection. Check the alignment and elevation of all column supports and location of all anchor bolts with transit and level instruments before starting erection. Notify architect of any errors. Obtain Architect's approval of methods proposed for correcting errors prior to proceeding with corrections and erection.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.7 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

### 3.8 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

- B. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- C. Column billets and bearing plates shall be supported and aligned on steel wedges, shims, or leveling nuts. After the supported members have been plumbed and properly positioned by instrument and anchor nuts tightened, the entire bearing area under the plate shall be packed solidly with grout specified in another Section. Wedges and shims shall be set back a minimum of 3/4" from the edges of plates and shall be left in place. Leveling plates are not permitted.
- D. Plumbing, Leveling and Bracing
  - 1. Structural steel shall be erected true and level, and temporary bracing shall be introduced wherever necessary to provide for all loads to which the structure may be subjected, including equipment and the operation thereof. Such bracing shall be left in place as long as may be required for safety. No welding shall be done or bolts drawn up tight until structural steel has been properly aligned. Obtain approval for guy locations to assure lack of interference with operations of other trades.
- E. Drifting
  - 1. Light drifting necessary to draw holes together will be permitted, but drifting of unfair holes will not be permitted. Twist drills shall be used to enlarge holes as necessary to the next larger size; use next larger size bolts as required. Reaming that weakens the members, or make it impossible to fill the holes properly or to adjust accurately after reaming, will not be allowed.

### 3.9 FIELD CONNECTIONS

- A. In addition to the requirements for shop connections comply with the following:
  - 1. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
  - 2. Joint Type: As noted on structural drawings.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

### 3.10 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Clean and prepare surfaces by SSPC-SP 3, Power Tool Cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 9."
- D. After erection, all damaged areas in shop coat, exposed surfaces of bolt heads, nuts and washers, and all field welds and unpainted areas adjacent to field welds and high strength bolts shall be painted with a "touch-up" application of same paint used in the shop coat and then painted with same paint used for shop coat tinted another color. Retouch in field, any scraped, abraded, and unpainted surfaces. Painting shall be as specified for shop coats.
- E. Structural steel which is to support mechanical equipment and will be left exposed to the weather in the finished project shall be field painted with one coat of anti-corrosive paint as described in Part 2 for Paint Materials.

### 3.11 WASTE MANAGEMENT

- A. Separate and recycle waste materials in accordance with the Section 017419 Construction Waste Management and Disposal and to the maximum extent feasible.
- B. Separate for recycling and place in designated containers the following metal waste in accordance with the Waste Management Plans and local recycler standards: Steel, iron, galvanized steel, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass and bronze.
- C. Collect all metal cut-offs and scraps and recycle as above.
- D. Fold up metal banding, flatten and place in designated area.
- E. Close and seal tightly all partly used paint and finish containers and store protected in a well-ventilated, fire-safe area at moderate temperature.
- F. Designated un-used paint for:
  - 1. Immediate re-use
  - 2. Long term maintenance needs
  - 3. Recycling by an appropriate facility.
  - 4. Donation
- G. Place empty containers of solvent-based paints in areas designated for hazardous materials.
- H. Do not dispose of paints or solvents by pouring on the ground. Place amounts too small to re-use in designated containers for proper disposal

- I. Place materials defined as hazardous or toxic waste in designated containers.

END OF SECTION

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Section 05 31 00  
STEEL DECKING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes but is not limited to the following as shown on the drawings and as specified herein:
  - 1. Floor deck
  - 2. Roof deck
  - 3. All necessary deck supports and reinforcing other than principal framing members including diagonals at columns, angles, plates, etc.
  - 4. Flashing, cell closures, closure plates and sheet metal work required to contain concrete.
  - 5. Ceiling hanger tabs at new decking composite with concrete where new suspended ceilings are required.
  - 6. Waste Management
- B. Related Requirements:
  - 1. Division 01 "Construction Waste Management Plan"
  - 2. Division 01 "Sustainable Design Requirements"
  - 3. Concrete and reinforcement over decking
  - 4. Structural steel
  - 5. Shoring of metal deck where unsupported span exceeds the allowable
  - 6. Ceiling systems
  - 7. Mechanical and electrical where supported from deck
  - 8. Fireproofing systems
  - 9. Sheet metal work

1.3 SUSTAINABLE DESIGN REQUIREMENTS

- A. The Contractor is to implement practices and procedures to meet the Project's Sustainable Design goals, which include achieving LEED v4 Silver. The Contractor shall ensure that the requirements related to these goals, as defined in this Section and in Related Sections of the Contract Documents, are implemented. Substitutions, or other changes to the Work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the Project's Sustainable Design goals.
- B. Related Sections: Following description of work is included for reference only and shall not be presumed to be complete:
  - 1. Provision of waste management: Section 017419, Construction Waste Management Plan.

2. Provision of general LEED requirements and forms: 018113 Sustainable Design Requirements.
- C. The Contractor is to efficiently use resources and energy while executing the Work of this Section. Resource efficient aspects to be considered in completing this Project include the use of techniques that minimize waste generation, reuse of construction materials on site where possible, and recycling of waste generated during the construction process.
- D. Performance Requirements: The following criteria are required for the products included in this section
1. Preference shall be given to decking containing raw materials harvested or extracted, and processed within 500 miles of the project site.
  2. All steel decking, and other steel products including but not limited to studs, reinforcement bar, fasteners, and clips required by the work of this section shall contain a minimum of 50% (combined) pre-consumer/post-consumer recycled content.
  3. Adhesives, sealants, paints and coatings used for the work of this section shall meet the Volatile Organic Compound (VOC) limits specified in Section 018113 "Sustainable Design Requirements," where applicable.
  4. Where welding is required use Submerged Arc Welding (SAW). The Gas Metal Arc Welding (GMAW) shall be used were SAW is not applicable (such as for angled connections and anything irregular or short). Field welding shall be allowed only in special circumstances; in such cases Flux Core Arc welding (FCAW) shall be specified with the use of portable fume exhaust system.
  5. Use surface preparation techniques that minimize the use of halogenated solvents and solvents classified as volatile organic compounds.
- E. LEED Performance Requirements:
1. Certification of recycled content, sourcing of materials, and VOC content shall be in accordance with the LEED Submittals requirements of this section.
- 1.4 LEED SUBMITTALS
- A. Submit LEED Certification items as follows:
1. Provide manufacturer's product documentation for each product having an Environmental Product Declaration (EPD).
  2. Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- B. Recycled Content
1. Provide manufacturer's product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
  2. Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.



- C. Provide manufacturer's or third-party certification of testing to and compliance with the California Department of Public Health (CPDH) Standard method v1.2-2017.
- D. Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
- E. Complete "LEED Material Documentation Sheet" with IEQc2 information for paints/coating installed within the waterproofing membrane.
- F. Letters of Certification: Provided by the manufacturer on the manufacturer's letterhead, verifying the amount of recycled content.
- G. Product Cut Sheets: For all materials that meet the sustainable design performance criteria as per the LEED Performance Requirements of this section.
- H. Material Safety Data Sheets (MSDS): For all applicable products. Applicable products include, but are not limited to, adhesives, sealants, paints, and coatings applied to the interior of the building. MSDS shall indicate the Volatile Organic Compound (VOC) content of products submitted. If an MSDS does not indicate VOC content, then product data sheets, manufacturer's literature, or certification letter indicating a product's VOC content can be submitted with the MSDS.
- I. Assemble required LEED Submittal information into one (1) package for each Specification Section or sub-contractor. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submittal products or assemblies.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Metal deck unit sizes and gauges are indicated on the drawings. Gauges indicated on the drawings are a minimum. Thickness of deck may be required to be increased by deck manufacturer for loadings indicated on drawings.
- B. Unit shall span over three or more supports except where steel layout does not permit.
- C. Maximum allowable deflection under live load plus super imposed dead load shall not exceed (1/360) of the span or (1/4) inch whichever is less.
- D. Deck shall be sized as unshored. Shoring of deck is not permitted unless specifically shown in areas on the drawings.
- E. Use of piercing, non-piercing, and integral hanger tabs is not permitted at roof deck.
- F. Units included in a fire rated assembly must be classified in appropriate UL design.

#### 1.6 SUBMITTALS

- A. Product Data: Product data, including manufacturer's specifications, load tables, section properties and installation instructions for each type of decking and accessories.
- B. Shop Drawings: Shop drawings for all installations showing gauges, deck layout, type of deck, any shoring required, where located, welding details necessary for

fabrication to fit in place, and all accessories. Do not use reproductions of the Design Drawings. In addition, include the following:

1. Ceiling tab, fillers, closures and similar items.
  2. Show placement of headed shear studs connectors with respect to the flutes of the metal deck. Variation from the specified deck configuration may result in a decrease of the capacity of the studs, requiring more studs.
- C. Product Certificates: Certification of specification compliance for each item specified.
- D. Reports
1. Submit certification of recycled steel content. Certification shall clearly indicate post-consumer AND post-industrial recycled steel content for the particular member or members used.
  2. Submit verification of finishing process:
    - a. Provide a cut sheet and a Material Safety Data Sheet (MSDS) for all shop and field paints used highlighting VOC limits and chemical and mineral component limits.
    - b. For heavy metals in used plating processes: Provide a cut sheet and a Material Safety Data Sheet (MSDS) for each plating material and related compounds highlighting chemical component limits.
    - c. Certification of recycled zinc content for galvanized products: Provide cut sheets clearly indicating whether the galvanized products used meet the minimums for post-consumer OR post-industrial recycled contents. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and if the recycled content is post-consumer or post-industrial.
  3. Submit verification of biodegradable or low VOC, and low Hazardous Air Pollutants (HAPS) cleaning solutions. Provide a cut sheet and a Material Safety Data Sheet (MSDS) for all cleaning solutions used in the surface preparation of steel components. Highlight VOC limits and chemical component limits.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
1. Power-actuated mechanical fasteners.
- F. Evaluation Reports: For steel deck.

1.7 QUALITY ASSURANCE

1. New York State Building Code, 2020
2. American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Steel Structural Members".
3. American Welding Society (AWS), D1.1 "Structural Welding Code" and D1.3 "Structural Welding Code-Sheet Steel".
4. Steel Deck Institute (SDI) "Design Manual for Composite Decks, Form Decks, and Roof Decks".

5. American National Standards Institute (ANSI)/Steel Deck Institute (SDI) "Quality Control and Quality Assurance for Installation of Steel Deck".
  6. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.
- B. Fabricator Qualifications: The work under this section shall be performed by a fabricator and erector submitting conclusive evidence of having satisfactorily completed work of similar scope and of having the necessary skill, equipment, facilities and capacities to fabricate and perform the erection in accordance with the construction schedules and in full compliance with all requirements of the Contract Documents.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work. However, efforts should be made to minimize the disturbance to site and soil conditions for example, by not requiring excessive areas to be put aside for on-site storage.
- B. Store materials to permit easy access for inspection and identification. Keep all materials in a safe, dry, off ground location, using pallets, platforms, or other supports. Protect all materials from corrosion and deterioration, discoloration or staining. Make efforts to minimize any wastage and ensure that as much waste as possible is recycled.
- C. Do not store materials on structure in a manner that might cause distortion or damage to members of supporting structures. Repair or replace damaged materials or structures as directed.

#### 1.9 PROJECT CONDITIONS

- A. Examine all work prepared by others to receive work of this section and report any defects affecting installation to the contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.
- B. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of the steel decking units, the steel decking contractor shall bring the matter to the attention of the contractor for corrective action. The steel decking units are not to be placed until the necessary correlations are made.
- C. Installation of the deck and shear studs will be inspected by the Architect and/or Owner's agent.

### **PART 2 - PRODUCTS**

#### 2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

## 2.2 MANUFACTURERS

- A. Supply manufactured deck units in accordance with the applicable requirements of the Steel Deck Institute's "Design Manual for Floor Decks and Roof Decks".
- B. Deck shall be manufactured by one of the following (or other equivalent as approved by the architect and engineer of record):
  - 1. United Steel Deck (manufactured by Canam)
  - 2. New Millennium
  - 3. Vulcraft

## 2.3 DECK MATERIALS

- A. Provide products with Third Party Environmental Product Declaration (EPD) whenever available.
- B. Provide products with recycled content of at least 60%.
- C. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- D. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, with the minimum section properties indicated on the drawings. Contractor shall provide heavier gauge if minimum gauge indicated is not adequate to support total loads as shown on the drawings.
- E. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated on the drawings. Contractor shall provide heavier gauge if the minimum gauge indicated is not sufficient to support construction loads as unshored forms and/or total load as indicated on the drawings based on the composite section. Deck shall have deformations specifically designed to produce composite action between the deck and the concrete slab by mechanical bond.
- F. Non-composite Form Deck: Fabricate ribbed-steel sheet non-composite form-deck panels to comply with "SDI Specifications and Commentary for Non-composite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated on the drawings. Contractor shall provide heavier gauge if minimum gauge indicated is not adequate to support total loads as shown on the drawings.

## 2.4 ACCESSORIES

- A. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- C. Anchor clips, vent clips, welding washers, flashing, saddle plates, sump pans, other accessories shall be those types, sizes, and configurations recommended by the

decking manufacturer, and shall be of the same material and finish as the deck units. All accessories shall conform to ASTM A653/A63M.

- D. Cell closure flexible strips, and fillers shall be of material in compliance with applicable building code governing class of construction.
- E. Provide metal closure strips at edges of all slabs and openings that serve as pour stops for concrete. Gauge shall be sufficient to span or cantilever from steel beams.
- F. Roof sump pans: Fabricate from a single piece of galvanized sheet steel of the same quality as the deck units; not less than nominal 0.0747" (14 gauge) thick before galvanizing; with bottoms level after erection and sloping sides to direct water flow to the drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3" wide. Recess pans not less than 1 1/2" below the roof deck surface, unless otherwise shown or required by deck configuration. Weld to deck at maximum 12" on-center.

## 2.5 FABRICATION

- A. Fabricate deck units in accordance with the AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and accepted shop drawings. Fabricate deck units to the sizes and configurations indicated and cut to lengths which will span not fewer than three supporting members; use only full length units at overhang where indicated in a manner that laps fit tightly. Locate openings for penetrations where indicated and provide support framing and edge reinforcement for all openings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSPECTION

- A. Inspection of the metal deck and shear stud installation will be performed by an inspection agency retained by the owner at no expense to the contractor. The inspection agency shall work under the direction of the owner. Contractor shall provide the inspection agency with the following:
  - 1. Schedule of all work in both shop and field with at least ten days written notice before commencement of either activity.
  - 2. A complete set of approved shop and erection drawings.

### 3.3 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section. Erection shall closely follow the erection of structural steel.

- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members as per load schedule provided on contract documents.
- D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work, per drawings and manufacturer's specifications.
- F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- G. All welding shall be performed by competent experienced welding mechanics. Welding mechanics must have AWS D1.3 certification for welding sheet metal less than 1/8 inch thick. All welds shall be given a protective coat of paint as specified in painting article of section 051200.
- H. All abraded or damaged protective surfaces of steel decking work shall be touched up with a protective coat of paint by this contractor as erected.

#### 3.4 ROOF DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members per drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports per drawings.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing per manufacturer's specification but not less than 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.
- D. All unframed openings in roof deck shall be reinforced per the drawings.
- E. Roof sump pans: Fabricate from a single piece of galvanized sheet steel of the same quality as the deck units; not less than nominal 0.0747" (14 gauge) thick before galvanizing; with bottoms level after erection and sloping sides to direct water flow to the drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3" wide. Recess pans not less than 1 1/2" below the roof deck surface, unless otherwise shown or required by deck configuration. Weld to deck at maximum 12" on-center.
- F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
  - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

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3.5 FLOOR DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members per the drawings. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports per the drawings.
- B. End Bearing: Install deck ends over supporting frame with a minimum end bearing per manufacturer's specification but not less than 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Lapped 2" minimum or butted at Contractor's option.
- C. All unframed deck openings in composite deck with concrete larger than 6" shall be reinforced per the drawings.
- D. At composite deck with concrete, metal hanger tabs shall be installed at all panel sidelaps 24 inches on-center, longitudinally 24 inches on-center to create a grid nominally 24 inches by 24 inches. Tabs shall be 18 gauge minimum, capable of supporting the specified ceiling, tabs shall be a minimum of 18 gauge capable of supporting ceiling and all other suspended loads or 200 pounds, whichever is greater.
- E. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- F. Sealing cellular deck openings, butt joints, and junctions with trench headers with tape is not included in this Section. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.
- G. The steel decking units shall be placed on the supporting steel framework and adjusted to final position before being permanently fastened. Each unit shall be brought to proper bearing on the supporting beams.
- H. Deck shall, where possible, span 3 or more supports.
- I. The side laps of adjacent units shall be fastened by approved method (to be shown on shop drawings) between supports at intervals as noted on the drawings.
- J. All welding shall be performed by competent experienced welding mechanics. Welding mechanics must have AWS D1.3 certification for welding sheet metal less than 1/8 inch thick. All welds, shall be given a protective coat of paint as specified in painting article of Section 051200.
- K. All abraded or damaged protective surfaces of steel decking work shall be touched up with a protective coat of paint by this contractor as erected.
- L. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.6 FIELD QUALITY CONTROL

- A. Special Inspection as required by the applicable Building Code of all metal decking will be performed by an inspection agency retained by the Owner at no expense to the Contractor. The inspection agency shall work under the direction of the owner. Contractor shall provide the inspection agency with the following:
1. Schedule of all work in field with at least ten days' written notice before commencement of either activity.
  2. A complete set of approved shop and erection drawings.
  3. Order sheets, material bills, shipping bills and mill test reports.
  4. Representative sample pieces as requested by the testing agency.
  5. Full and ample means and assistance for testing all material.
  6. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.
- B. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person making the connection.
- C. The following minimum criteria shall be adhered to in testing of welds:
1. All welds shall be examined by visual means.
  2. 25% of all welds, selected randomly, shall be measured.
  3. In addition, all welds subject to tensile stress shall be examined by the Ultrasonic Method for 100% of their length.
  4. 10% of all manual fillet welds shall be tested by the magnetic particle method.
  5. 1'-0" at each end of automatic fillet welds shall be tested by the magnetic particle method.
  6. 100% of groove welds shall be tested by the ultrasonic method.
- D. Field inspection will include examination of decking for welding and touching up of shop coat.
- E. Inspection of welding will be such as to assure that the work is within the quality requirements specified below and elsewhere in this section of the specifications and will include:
1. Ascertainment that the electrodes and flux used for the SAW, GMAW and FCAW welding processes conform to the requirements of this section of the specifications.
  2. Ascertainment that the approved welding procedures and sequence are followed without deviation, unless specific approval for change is obtained from the architect.
  3. The testing agency shall be prepared to utilize the following approved methods of testing:
    - a. Liquid penetrant inspection: ASTM E 165.
    - b. Magnetic particle: ASTM A 709.
    - c. Radiographic inspection: ASTM E 94 and E 1032.
    - d. Ultrasonic inspection: ASTM E 114 and AWS, Chapter 6, Section C.



- F. When defects are revealed, additional inspection by whatever method is deemed necessary by the inspector, shall be performed to the extent necessary to assure that the full amount of defect has been located. No further work shall be done on the assembly or sub assembly in question until all the necessary corrections have been made. Defects shall be repaired, using the same welding procedure that was used initially in making the weld, unless otherwise approved by the architect. Inspection of the repaired weld shall be by the same method that was used to reveal the defect. A second repair of a defective area shall not be made without approval of the Architect.
- G. A distinguishing mark will be placed on all work that has been inspected and approved. Material or work that is not acceptable will be designated by words such as "REJECT" or "REPAIR" marked directly on the material or work.
- H. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- I. Remove and replace work that does not comply with specified requirements.
- J. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

### 3.7 CLEANING UP

- A. Remove all equipment, unused materials and debris from the site immediately upon the completion of this work.

### 3.8 WASTE MANAGEMENT

- A. Separate and recycle waste materials in accordance with the Section 017419 Construction Waste Management and Disposal and to the maximum extent feasible.
- B. Separate for recycling and place in designated containers the following metal waste in accordance with the Waste Management Plans and local recycler standards: Steel, iron, galvanized steel, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass and bronze.
- C. Collect all metal cut-offs and scraps and recycle as above.
- D. Fold up metal banding, flatten and place in designated area.
- E. Close and seal tightly all partly used paint and finish containers and store protected in a well-ventilated, fire-safe area at moderate temperature.
- F. Designated un-used paint for:
  - 1. Immediate re-use
  - 2. Long term maintenance needs
  - 3. Recycling by an appropriate facility.
  - 4. Donation
- G. Place empty containers of solvent-based paints in areas designated for hazardous materials.

- H. Do not dispose of paints or solvents by pouring on the ground. Place amounts too small to re-use in designated containers for proper disposal
- I. Place materials defined as hazardous or toxic waste in designated containers.

End of Section

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Section 05 50 00  
METAL FABRICATIONS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
  - 1. Steel stairs with intermediate landing construction, complete with all supporting members and railings.
  - 2. Decorative exterior railings.
  - 3. Above ceiling supports for toilet partitions and suspended products furnished under other sections.
  - 4. Elevator pit ladders.
  - 5. Elevator sill support angles.
  - 6. Hot dipped galvanized ADA accessible grating at existing areaways.
  - 7. Elevator sump pit grating.
  - 8. Exterior railings.
  - 9. Restraining angles at top of masonry walls.
- B. Furnish the following items for installation under related sections:
  - 1. Anchors, bolts, inserts, and sleeves, required to attach miscellaneous metals for embedment into concrete under Section 03 30 00 - CAST-IN-PLACE CONCRETE.
  - 2. Loose steel lintels at door, window, ductwork and similar openings in interior masonry partitions; installed under Section 04 20 00 - UNIT MASONRY.
  - 3. Anchor bolts, with nuts and washers; inserts; and sleeves; required to attach miscellaneous metal items to masonry, for installation under Section 04 20 00 - UNIT MASONRY.
- C. Perform all drilling and cutting in miscellaneous metal items required for the attachment of other items.
- D. Core drill concrete stairs and ramps; grout into place railing posts.
- E. Perform all shop-painting for all surfaces of exposed to view galvanized and non-galvanized metals, and post-erection touch-up of shop prime coat, using the same material as shop-prime coating.

### 1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing areaway grating.
- D. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Installation of anchors into concrete, pouring concrete stair treads and landings.
- E. Section 05 12 00 - STRUCTURAL STEEL FRAMING:
  - 1. Elevator machine beams and hoist beams.
  - 2. Structural steel framing members not otherwise specified hereunder.
- F. Section 05 31 00 - STEEL DECKING: Metal roof deck and floor decking.
- G. Section 05 52 00 - MISCELLANEOUS SITE METAL.
- H. Section 05 70 13 - DECORATIVE METALS – BRASS / BRONZE.
- I. Section 06 10 00 - ROUGH CARPENTRY: Wood framing, blocking, subflooring and underlayment.
- J. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Non-loadbearing metal framing systems for interior partitions and ceilings.
- K. Section 09 91 00 - PAINTING: Applied finish coatings other than those specified herein.
- L. Section 14 21 00 - TRACTION ELEVATORS:
  - 1. Elevator guide rails
  - 2. Hoistway entrance door sills.

### 1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - References. . Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. ASTM A 36 - Structural Steel.
  - 1. ASTM A 53 – Pipe, Steel, Black and Hot-Dipped, Zinc-coated, Welded and Seamless Steel Pipe.
  - 2. ASTM A 108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
  - 3. ASTM A 123 - Zinc Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
  - 4. ASTM A 153 - Zinc-Coating on Iron and Steel Hardware.
  - 5. ASTM A 283 - Carbon Steel Plates, Shapes, and Bars.

6. ASTM A 307 - Carbon Steel Externally Threaded Standard Fasteners.
7. ASTM A 325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
8. ASTM A 361 - Zinc Coated (Galvanized) Iron or Steel Roofing sheets.
9. ASTM A 385 – Providing High Quality Zinc Coatings.
10. ASTM A 380 – Standard Practice for Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment and Systems.
11. ASTM A 386 - Zinc Coating on Assembled Steel Products.
12. ASTM A 446 - Zinc Coated (Galvanized) Steel Sheets of Structural Quality, Coils and Cut Lengths.
13. ASTM A 501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
14. ASTM A 525 - Specification for Sheet Steel, Zinc Coated (Galvanized).
15. ASTM A 780 – Repair of Hot-Dip Galvanizing.
16. ASTM A1011/A1011M - Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
17. ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus.
18. ASTM A 575 Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
19. ASTM A576 Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
20. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
21. AGAI - Inspection Manual for Hot-Dipped Galvanized Products.
22. AISC - Code of Standard Practice for Steel Buildings and Bridges.
23. AISC - Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.
24. AWS - Standard Code for Arc and Gas Welding in Building Construction.
25. MIL-P-21035B - Paint High Zinc Dust Content, Galvanizing Repair (Metric) (superseding DOD-P-21035A)
26. SSPC referenced standards.
27. NAAMM publication AMP 500 – Metal Finishes Manual
28. NAAMM publication AMP 510 – Metal Stairs Manual.
29. NAAMM publication AMP 521 – Pipe Railing Manual
30. NAAMM publication AMP 555 – Code of Standard Practice for The Architectural Metal Industry.
31. SSPC standards referenced herein, including:
  - a. SSPC-SP1, Surface Preparation – Solvent Cleaning,
  - b. SSPC-SP2, Surface Preparation – Hand Tool Cleaning.
  - c. SSPC-SP3, Surface Preparation – Power Tool Cleaning
  - d. SSPC-SP8, Surface Preparation - Pickling.

- e. SSPC-Paint 20, Zinc-Rich Coating (Type 1) Inorganic and (Type II) Organic.
- f. SSPC-Paint 29, Zinc Dust Sacrificial Primer Performance.

B. Definitions:

- 1. AESS: Architectural Exposed Structural Steel. Includes all exposed-to-view fabricated steel elements furnished under the scope of this Section 05 50 00.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

- 1. Be responsible for establishing locations and levels for all work of this Section, except such parts as may be delivered to others and set by them. In such cases assist them in properly locating said parts.

B. Pre-Installation Meetings: At least two weeks prior to commencing fabrication work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

- 1. Required attendees: Architect, Contractor, Installer's Project Superintendent, and representatives of other related trades as directed by the Architect or Contractor.
- 2. Agenda:
  - a. Scheduling of metal fabrications operations.
  - b. Quality control for AESS fabricated components.
  - c. Finish and installation requirements for AESS fabricated components.
  - d. Review of staging and material storage locations.
  - e. Coordination of work by other trades.
  - f. Installation procedures for ancillary equipment.
  - g. Protection of completed Work.

C. Sequencing:

- 1. Field Measurements
  - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
  - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

D. Scheduling:

- 1. Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's complete product data and specifications for all prefabricated items, shop primer paints, liquid zinc coating, and hydraulic cements, to be furnished hereunder.
    - a. For epoxy anchoring systems: Furnish ICC-ES Code approvals and performance data that includes recommended loading for each application.
  2. Shop Drawings, bearing registration stamp of a Professional Structural Engineer registered in State of New York
    - a. General requirements:
      - 1) Include large scale details of items of all metal fabrications to be furnished hereunder, showing proposed methods of anchorage to surrounding structure and conditions.
      - 2) Indicate on the shop drawings all erection marks for various places of miscellaneous metals, and ensure that the actual field pieces bear corresponding marks.
      - 3) Indicate shop built components, and field-built components.
      - 4) Indicate and detail all field installation connections.
      - 5) Indicate weld types and length.
      - 6) Indicate blocking locations.
      - 7) Indicate seam locations in high-strength steel members
    - b. Include large scale details of stairs, intermediate landings, railings and balustrade.
    - c. Include large scale details of metal fabrications supporting work of other trades.
  3. Selection Samples:
    - a. Sample card indicating Manufacturer's full range of colors of shop applied finishes available for selection by Architect.
  4. Verification Samples: Accepted samples will be used to establish the quality standard for fabrication, workmanship and finish.
    - a. Factory/shop finishes: 3 inch by 6 inch samples of factory-applied coatings and colors proposed for use for approval prior to coating application.
    - b. Handrail, quality assurance sample with railing, pickets and escutcheons: Fabricate a sample showing a typical handrail section demonstrating component connections. Sample section shall be minimum 18 inches in horizontal length and 12 inches in height and include a corner post. Provide a shop primed finish.
    - c. Provide minimum 24 by 24 inch (or equivalent for shapes) of fabricated and finished ornamental metal components, demonstrating the quality of fabrication work, and finish.
    - d. Provide 12 inch sections of fabricated and finished AESS metal components, demonstrating the quality of welds and finish.

- e. Provide a sample board of weld, joining and termination conditions to be used for all AESS fabrications and for samples of exposed to view welding conditions demonstrating NOMMA Weld Level 1 (no visible welds).
5. Certificates:
- a. Certificate of Compliance from Galvanizer: Submit notarized Certificate of Compliance with application for payment for galvanizing, signed by galvanizer, indicating compliance with requirements of specifications. Include scope of services provided, and quantity and itemized description of items processed.
  - b. Welders certificates as specified under Article entitled "QUALITY ASSURANCE".
6. Delegated Design Submittals: Provide calculations for loading and stresses for the work of this section, bearing the Professional Structural Engineer's seal. Show how design load requirements and other performance requirements as required by the Building Code of New York State, 2020 edition have been satisfied.
- a. Work scope requiring loading and stress calculations includes, but is not limited to the following:
    - 1) Stairs, intermediate landings and railings.
    - 2) Metal fabrications supporting work of other trades.
    - 3) Seismic restraints.
    - 4) Ledge and shelf angles.
    - 5) Access ladders and roof-top ladders.
    - 6) Mechanical equipment platforms.
    - 7) Overhead supports.
    - 8) Areaway gratings.
    - 9) Wall mounted television brackets.
7. LEED Submittal Requirements:
- a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
    - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
      - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
      - b) EPD shall have at least Cradle to Gate scope,
    - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
    - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
      - a) Itemized vendor invoices for FSC-certified products.
      - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site



installers of FSC-certified products must have CoC certification only if they modify the products off the project site.

- 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.

- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
  1. Special Inspections: Submit prior to request for Certificate of Occupancy, to both Architect and local Building Official having jurisdiction, the following:
    - a. All certifications, reports and programs required by Building Code of New York State, 2020 edition for work engineered by Contractor's Professional Engineer under the requirements of this Section.

#### 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Exposed Fabricated Steel Elements including stairs, railings, ornamental fabrications and exposed to view fabrications shall be fabricated and finished as Architectural Exposed Structural Steel (AESS) meeting tolerances and fabrication requirements as specified herein.
- C. Qualifications:
  1. Fabricator/Installer: Minimum of 5 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
  2. Welders: Utilize only qualified welders employed on the Work. Submit verification that Welder's are AWS D1.1 and D1.4 qualified within the previous 12 months.
  3. Licensed Professionals: Provide the services of a Professional Structural Engineer, registered in the State of New York to design and certify that the work of this section meets or exceeds the performance requirements specified in this section and as required by the Building Code of New York State.
    - a. Prepare Shop Drawings for under direct supervision of a same Engineer experienced in design of this work.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  1. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Subcontract, have been received and approved by the Architect.
- B. Storage and Handling Requirements:
  1. Handle and store materials under cover in a manner to prevent defacement, deformation, or other damage to the materials and to shop finishes, and to prevent the accumulation of foreign matter on the metal work. All such work shall be repaired and cleaned prior to erection.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: All materials shall be new stock, free from defects impairing strength, durability or appearance, and of best commercial quality for each intended purpose. Unless specifically called for otherwise, work shall be fabricated from the following:
1. Carbon Steel:
    - a. Steel shapes, plates and bars: ASTM Designation A 36.
    - b. Steel pipe: ASTM A53, grade A, seamless pipe, black finish unless otherwise noted.
    - c. Structural steel tubing, square and rectangular shapes: ASTM A500, Grade B.
    - d. Steel tubular shapes: ASTM A 501.
    - e. Steel plates to be bent or cold-formed: ASTM A283, grade C.
    - f. Steel bars and bar-size shapes: ASTM A36.
    - g. Cold-finished steel bars: ASTM A108.
    - h. Galvanized carbon steel sheets: ASTM A526, with G90 zinc coating in accordance with ASTM A525.
- B. Recycled content of Ferrous Metals: Use maximum available percentage of recycled steel. Steel incorporated into the work shall contain not less than 25 percent of recycled steel.
- C. Steel materials: to be hot dip-galvanized: Provide steel chemically suitable for metal coatings complying with the following requirements: Carbon below 0.25 percent, silicon below 0.24 percent, phosphorous below 0.05 percent, and manganese below 1.35 percent. Notify galvanizer if steel does not comply with these requirements to determine suitability for processing.
- D. Metal surfaces, general: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
- E. Welding rods: AWS E70XX grade, or select in accordance with AWS specifications for the metal alloy to be welded and in accordance with the recommendation of the welding rod manufacturer.
1. Where stainless steel is welded to mild steel, select rods to minimize dilution effects on the stainless steel component.

### 2.2 UNIVERSAL GRID SYSTEM

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Unistrut Corporation, Itasca IL.

1. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following.
    - a. Unistrut Corporation, Itasca IL., product "Unistrut"
    - b. Cooper US, Inc., Houston TX., product "Cooper B-Line".
    - c. Gleason Partners, LLC., Grand Rapids, MI., product "Strut Channel Systems".
    - d. Thomas & Betts Corporation, Memphis TN, product "Kindorf Superstrut".
  2. There are no other manufacturers of this product type available in the United States, fabricators may choose to fabricate grid system components using structural steel shapes, with submittal and approval of complete engineering Drawings and calculations as a substitution.
- B. General: Manufactured grid system as manufactured by Unistrut Corp, Wayne MI.
1. Finish:
    - a. Zinc coated after all manufacturing operations are complete. Coating shall conform ASTM A 123 or A 153.
- C. All channel members shall be fabricated from structural grade steel confirming to the following ASTM specifications:
1. ASTM A 653 Grade A
- D. All fittings shall be fabricated from steel conforming to one of the following ASTM specifications:
1. ASTM A 36, A 575, or A 576.
- E. All materials shall be stamped and identifiable by manufacturer and part number (where appropriate). Materials that appear damaged, distressed, unidentifiable or rusted shall not be used and will not be accepted.

## 2.3 FASTENERS

- A. General: Provide all fasteners and attachments as required for work specified herein and as indicated on the Drawings.
1. In general,
    - a. Provide all fasteners and attachments of the same material and finish as the metal to which it is applied unless otherwise noted.
      - 1) Provide Type 304 stainless-steel fasteners for exterior use.
      - 2) Provide Type 304 stainless-steel fasteners for fastening aluminum.
- B. Steel Bolts, Nuts and Washers: ASTM A307, galvanized to ASTM A153 for galvanized components.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- D. Eyebolts: ASTM A 489.
- E. Machine Screws: ASME B18.6.3.

- F. Lag Bolts: ASME B18.2.1.
- G. Wood Screws: Flat head, ASME B18.6.1.
- H. Plain Washers: Round, ASME B18.22.1.
- I. Lock Washers: Helical, spring type, ASME B18.21.1

## 2.4 ACCESSORIES

- A. Adhesive for attaching anchors and for direct pinning: high-modulus, high strength, moisture tolerant, epoxy adhesive, two-component 100 percent solids, epoxy resin complying with ASTM C 881.
  - 1. Minimum performance properties (as cured at 70 degrees F. and 50 percent relative humidity):
    - a. Minimum Compressive Strength, tested per ASTM D-695:
      - 1) at 3 days: 11300 psi (31.0 MPa).
      - 2) at 7 days: 11800 psi (44.8 MPa).
      - 3) at 28 days: 12200 psi (58.6 MPa).
    - b. Shear Strength, tested per ASTM D-732 at 14 days: 6200 psi (43 MPa)
    - c. Minimum Flexural Strength tested per ASTM D-790 at 14 days: 10700 psi (74 MPa).
    - d. Minimum Bond Strength tested per ASTM C-882 at 14 days:
      - 1) Plastic Concrete to Hardened Concrete 2200 psi (13.8 Mpa).
      - 2) Plastic Concrete to Steel 2000 psi (13.8Mpa).
    - e. Maximum Water Absorption, tested per ASTM D-570: 24 hour 0.27%
    - f. Minimum Tensile properties tested per ASTM D-638: Tensile Strength 6900 psi (48 Mpa).
  - 2. Products which may be considered as equal include the following, or approved equal:
    - a. Sika Corporation, Lyndhurst NJ., product: "Sikadur 32 Hi-Mod Gel.
    - b. Simpson Strong Tie, Pleasanton, CA., product "SET High Strength Epoxy".
    - c. Symons Corporation, Des Plaines, IL., product "Rescon Gel anchor 304".
- B. Grout: Ready mixed, non-metallic high-strength controlled expansion grout of flowable consistency, conforming to ASTM C 1107 with minimum compressive strength of 8,000 pounds per square inch (55.2 MPa) at 28 days.
  - 1. Products which may be considered as equal include the following, or approved equal:
    - a. Five Star Products, Inc., Fairfield CT, product "Five Star Grout."
    - b. L&M Construction Chemicals, Omaha NE, Product: "Crystex."
    - c. BASF Construction Chemicals, Cleveland, OH., product "Masterflow 713".
    - d. Sika Corporation, Lyndhurst, NJ., product "SikaGrout 212".
    - e. ChemMasters, Madison, OH., product "Conset".
- C. Metal paste filler: 2 component epoxy, high strength, structural adhesive putty:
  - 1. Products which may be considered as equal include the following, or approved equal:

- a. Abatron, Inc. Gilberts IL, product: "Ferrobond-P".
  - b. Dynatron/Bondo Corp., Atlanta, GA, product: "Bondo Plastic Filler".
  - c. U.S. Chemical & Plastics Company., Massillon OH, product "Metal filled epoxy".
- D. Primer for non-galvanized steel surfaces, modified alkyd rust-inhibitive, high solids primer:
1. Products which may be considered as equal include the following, or approved equal:
    - a. Benjamin Moore product: "Metal Primer KP14-70", Gray Primer.
    - b. Rust-Oleum: 6100, Gray Primer.
    - c. Sherwin Williams: Kem Flash 500 Primer, Gray Primer E61A750.
    - d. Tnemec: V10-1009 Gray Primer.

## 2.5 FABRICATION - GENERAL

- A. Metal surfaces shall be clean and free from mill scale, flake, rust and rust pitting; well formed and finished to shape and size, true to details with straight, sharp lines, and angles and smooth surfaces. Curved work shall be to true radii. Exposed sheared edges shall be eased.
- B. Shop fabricate items wherever practicable, accurately fitting all parts and making all joints tight. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- C. Do all cutting, punching, drilling, and tapping required for attachment of anchor bolts and other hardware and for attachment of work by other trades. All such work shall be done prior to hot-dip galvanizing of the various components.
- D. Grind all edges of bars and plates completely free from nicks and machine marks, prior to galvanizing and/or shop priming.
- E. Grind all exposed-to-view welds completely smooth and flush to the surface plane of the base metals. Perform welding work prior to galvanizing in all cases, except where field welding is necessary, in which case, completely coat all such welds with two coats of specified liquid zinc coating, after performing grinding operations.
1. Finish welds on exposed to view components to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- F. Use screws and bolts only where welding cannot be performed, of sufficient size to ensure against loosening from normal usage of miscellaneous metal items furnished hereunder.
1. Countersink all screw heads and bolt heads as far as practicable. Use not less than two screw, bolts, or other anchorage items, at each connection point.
  2. Draw up all threaded connections tightly, after buttering same with pipe joint compound, to exclude water.
- G. Provision for Thermal Movement: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Design, fabricate and install for temperature change range of 120 degrees F, ambient temperature and 180 degrees F, material surfaces.
- H. Carefully coordinate the installation of metal fabrications with the work of trades responsible for the installation of interfacing work, and for the installation of work into the various assemblies furnished hereunder, and permit the installation of the related materials to be made at the appropriate times.
- I. Fit and assemble metal fabrications in largest practical sections for delivery to site, ready for installation.
  1. Galvanized assemblies: Where size of assembly is too large for galvanizing kettle, galvanize components prior to fabrication and assemble after galvanizing.

## 2.6 FABRICATION - STAIRS AND RAILINGS

- A. Refer to the Drawings for location and details of steel stairs and railings (handrails and guardrails) to be furnished and installed hereunder.
  1. Verify heights shown in Drawings comply with referenced codes and regulations.
  2. Verify field measurements with approved Shop Drawings prior to fabrication.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
  1. Concrete pan filled stairs:
    - a. Egress stairs: NAAMM Stair Standard, Commercial class.
    - b. Monumental stairs: NAAMM Stair Standard, Architectural class.
  2. Stairs with grated treads at mechanical systems: NAAMM Stair Standard, Service class.
- C. Performance requirements; conform to all requirements of those codes and regulations referenced under Section 01 41 00 - REGULATORY REQUIREMENTS.
  1. Stairs: Design, fabricate and install stairs to safely support a minimum live load of 100 pounds per square foot and a minimum concentrated load of 300 pounds on any area of four square inches, under the requirements of the International Building Code, Section 1607.
  2. Railings: Design, fabricate and install all railings in a manner which will ensure the railings will be capable of withstanding loads as follows and as required by the International Building Code, Section 1607.
    - a. Resist a load of 50 pounds per linear foot (0.73 kN/m) applied in any direction at the top.
    - b. Resist a single concentrated load of 200 pounds (0.89kN) applied in any direction at any point along the top.
    - c. Intermediate rails shall resist a horizontally applied load of 50 pounds (0.22 kN) on an area equal to 1 square foot (.093m<sup>2</sup>), including openings and space between rails.
- D. Sizes of all headers, stringers, and other structural members; and gauges and configurations of all riser tread and landing plates and pans, railings, stringers, and

posts shall be as indicated on the approved shop drawings, and in accordance with the standards of the National Association of Architectural Metal Manufacturers.

- E. General fabrication: Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure. Indicate on shop drawings sizes of all members, gages and configurations of stairs and railings.
1. Join components by welding unless otherwise indicated.
  2. Use connections that maintain structural value of joined pieces.
  3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
  4. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
  5. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
  6. Form exposed work with accurate angles and surfaces and straight edges.
  7. Weld connections to comply with the following:
    - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    - b. Obtain fusion without undercut or overlap.
    - c. Remove welding flux immediately.
    - d. Weld exposed corners and seams continuously unless otherwise indicated.
    - e. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
  8. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
  9. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
  10. Fabricate stringers of steel channels or tubes as indicated on Drawings.
    - a. Provide closures for exposed ends of channel and tube stringers
  11. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements.
  12. Weld stringers to headers; weld framing members to stringers and headers.
  13. Where stairs are enclosed by gypsum board or shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
  14. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

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- F. Fabrication, Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch (1.7 mm).
1. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
  2. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
- G. Fabrication, Metal Grating-type Stairs:
1. Fabricate treads and platforms from welded steel grating with openings in gratings no more than 5/16 inch (8 mm) in least dimension.
  2. Surface: Plain.
  3. Fabricate grating treads with cast abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
  4. Fabricate grating platforms with nosing matching that on grating treads. Provide toe-plates at open-sided edges of grating platforms. Weld grating to platform framing.
  5. Weld connections to comply with the general requirements specified herein, and:
    - a. At metal grating stairs and related railings for exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: Partially dressed weld with spatter removed.
- H. Fabrication, Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads and deflection criteria.
1. Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
    - a. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
  2. Form changes in direction of railings as indicated on drawings, with radius bends of radius indicated. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
  3. Close exposed ends of railing members with prefabricated end fittings.
  4. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
  5. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.



- a. Connect posts to stair framing by direct welding unless otherwise indicated.

## 2.7 FABRICATION - SUPPORTS

- A. Design, engineer and fabricate structural overhead support for equipment, furnishings, and products furnished under Sections, which includes, but is not limited to:
  1. Folding panel partitions.
  2. Accordion folding fire doors.
  3. Suspended television brackets.
  4. Equipment furnished under individual specification sections.
  5. Owner's furnished equipment.
  6. Above ceiling support for toilet partitions and similar products furnished under other sections.
- B. Fabricate support system to carry the entire load of supported products to building structure above without transferring any horizontal or vertical load to ceiling system(s). Provide frequently spaced holes for multiple adjustment. Provide diagonal bracing. Use of a "Universal Grid" system members is acceptable.
- C. Fabricate supports for equipment, fixtures, and appurtenances utilizing a "Universal Grid" system with rails extending wall-to-wall, perpendicular to the path of travel of the same.
  1. Design, engineer and fabricate supporting framework to support a concentrated load at any single point along the exposed rails, as exerted by the equipment to be purchased by the Owner.
    - a. Installed framework shall have a minimum loading safety factor of 2.5, based upon ultimate strength under static loading conditions.
    - b. The concentrated load shall be the maximum that will be encountered by positioning the equipment at the extremities of its travel (maximal load configurations).
    - c. Base loads on the most severe conditions as may be encountered by any of the manufacturers producing equipment for the type of services of the rooms indicated.
  2. Rail shall be on centers as required by equipment manufacturer and allow continuous attachment along any point on the rail.
  3. System shall be true, plumb and level to the tolerances indicated, with no more than  $1/720^{\text{th}}$  of the span maximum deflection in either plane, when maximum loading conditions are applied due to equipment operations.

## 2.8 FINISHES - HOT-DIP GALVANIZING

- A. Surface preparation prior to galvanizing: Pickle steel prior to galvanizing in conformance with SSPC-SP8. Remove all rust, dirt, weld flux, weld spatter, and other foreign matter.
- B. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.

1. Basis-of-Design: "Duncan Galvanizing, Everett, MA., product "Duragalv."
2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for bolts, nuts, washers, and other rough hardware. Provide thickness of galvanizing specified in referenced standards.
3. Wherever possible, perform galvanizing after assembly of items.
4. Galvanized items shall be straightened to remove all warpage and distortion caused by the galvanization process.
5. Fill vent holes after galvanizing (if applicable), and grind smooth.
6. Touch-up all breaks on hot-dip surfaces caused by cutting, welding, drilling or undue abrasion with liquid zinc coating as specified herein above. Apply liquid zinc by brush or spray on all damaged areas in two coats to a total dry film thickness of not less than 3 mils. Apply first coat within two hours after damage to hot-dip film to prevent undue oxidation of exposed surface. On all welds remove weld spatter by power wire brushing or equivalent before applying liquid zinc coating. Repair material should extend at least 3 inches beyond all edges of the damaged galvanized area as possible to assure continuity of galvanic protection.
7. Touch-up of galvanized surfaces with aerosol spray, silver paint, bright paint, brite paint, or aluminum paints is not acceptable.

## 2.9 FINISHES - SHOP APPLIED COATINGS

- A. Schedule: Shop applied coatings as indicated on Drawings, and as additionally specified and scheduled in this Section.
- B. For non-galvanized steel surfaces:
  1. Surface preparation prior to priming: Thoroughly clean all steel of all loose mill scale by power wire brushing or sandblasting. Remove all rust, dirt, weld flux, weld spatter, and other foreign matter by wire-brushing or scraping (power wire-brushing, if necessary). Grind smooth any sharp projections.
  2. Shop apply specified primers thoroughly and evenly on the surfaces and worked into the joints and other open areas on the surfaces. Surfaces inaccessible after assembly shall be given two coats. Dry film thickness of primer shall be not less than 2.4 mils per coat.
- C. Field touch-up: Shall be the responsibility of the installing contractor and shall include the filling, and touch-up of exposed job made bolt or screw holes, refinishing of raw surfaces resulting from job fitting, repair of job inflicted scratches and marks, and final cleaning up of the finished surfaces.
  1. Touch-up finishes shall be fully compatible with, and exactly match shop applied finish, color, texture and sheen.

## PART 3 - EXECUTION

### 3.1 ERECTION - GENERAL

- A. General: Accurately set all work to established lines and elevations, and rigidly fasten in place with suitable attachments to the construction of the building. At the completion of the work, check all work, re-adjust as required, and leave in perfect condition. Grind all exposed to view welds smooth to the touch.

- B. Setting bearing and leveling plates:
  - 1. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
  - 2. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
    - a. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
    - b. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- C. Miscellaneous framing and supports: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and additional requirements indicated on Shop Drawings.
  - 1. Anchor supports for operable partitions, and similar products, securely to and rigidly braced to building structure.

### 3.2 FIELD WELDING

- A. Field weld components indicated on approved shop drawings in accordance with AWS D1.1. Weld profile, quality, and finish shall be consistent with approved samples and mock-ups.
  - 1. Welds ground smooth: Erector shall grind welds smooth in the connections of AESS members. For groove welds, the weld shall be made flush to the surfaces of each side and be within + 1/16", -0" of plate thickness.
  - 2. Contouring and blending of welds: Where fillet welds are indicated to be ground contoured, or blended, oversize welds as required; grind to provide a smooth transition and to match profile on approved mock-up .
  - 3. Continuous Welds: Where noted on the drawings, provide continuous welds of a uniform size and profile.
  - 4. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.
- B. Immediately after welding, touch-up welds, burned areas and damaged surface coatings.
  - 1. Thoroughly remove all spatter by power wire-brushing (or if inaccessible, wire brushing) per SSPC, surface preparation specification SP2 or SP3. Allow surface to cool to ambient temperature. Clean surface with solvent wipe to remove oils, grease and dirt in accordance with SSPC surface preparation specification SP1.
  - 2. Apply one coat of liquid zinc to attain a minimum of 1.5 mils dry film thickness. Coating should extend at least two inches beyond either side of weldment to ensure complete coverage of welded area.

### 3.3 FIELD BOLTING

- A. Accurately drive all bolts into holes, protecting the bolt heads so as not to damage the thread during the driving. Ensure that bolt heads and nuts rest squarely against the metal. Where structural members have sloping flange faces, provide approved beveled washers at the bolted connections to afford square seating for bolt heads or nuts. Nick bolt threads for unfinished bolts to prevent the nuts from backing off.
  - 1. Bolt Head Orientation: All bolt heads shall be oriented as indicated on the contract documents. Where bolt-head alignment is specified, the orientation shall be noted for each connection on the erection drawings. Where not noted, the bolt heads in a given connection shall be oriented to one side.
- B. Use an approved calibrated manual or power torque wrench to obtain the proper torque and tension as recommended by the bolt manufacturer for all ASTM A 325 bolts.

### 3.4 INSTALLATION OF RAILINGS

- A. Adjust railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loading. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
  - 1. Anchor posts in concrete by means of pipe sleeves providing at least 1/2 inch clearance around entire perimeter of post, preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with nonmetallic, nonshrink grout, mixed and placed to comply with grout manufacturer's directions.
    - a. For setting into colored concrete; hold grout back 1/2 inch from finish surface and fill void with Portland cement grout matching color and texture of adjacent surface.
    - b. Leave anchorage joint exposed, wipe off surplus grout, and leave 1/8" build-up, sloped away from post.
  - 2. Anchor posts to steel with steel flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.
  - 3. Anchor rail ends into concrete and masonry with round steel flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.
  - 4. Anchor rail ends to steel with round flanges welded to rail ends and bolted to structural steel members, unless otherwise indicated.
  - 5. Install removable railing sections where indicated in slip-fit metal sockets cast into concrete. Accurately locate sockets to match post spacing.
- B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2" clearance from inside face of handrail and finished wall surface. Locate brackets as indicated, or if not indicated, at spacing required to support structural loads. Secure rails to walls with wall brackets, wall return fittings and anchor plates, in a manner required to meet code requirements, and as follows:
  - 1. Each bracket shall be fastened with not less than 2 bolts.

2. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.
3. For hollow masonry anchorage, use toggle bolts having square heads.
4. For steel framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors to steel reinforcing plate, using bolts of size and type required to support structural loads.
5. For wood stud partitions, use lag bolts set into wood blocking or backing between studs. Coordinate with stud installations for accurate location of blocking or backing members.

### 3.5 TOUCH-UP

- A. Touch-up all welds, burned areas, scratches, abrasions, on galvanized metals, using specified liquid zinc coating.
- B. Touch-up all welds, scratches, abrasions, and other surface damaged on shop-primed or painted metals, using the same coatings as specified under shop applied finishes, herein above.

### 3.6 SUPPLEMENTAL SCHEDULES

- A. General: Items listed herein below provide further description of those already indicated in the Drawings. This list does not represent a complete list of miscellaneous metal components or types required to complete the Work.
  1. Carefully review all Drawings and furnish and install metal fabrications required by the various trades, whether or not specifically listed herein, such as miscellaneous clip angles, miscellaneous steel bracketing, and other miscellaneous metal items as indicated on the Drawings, reasonably implied therefrom, or reasonably necessary for the thorough completion of the work.
- B. Steel pan stair and related support components, as detailed on the Drawings and specified herein above.
- C. Interior steel railings (guardrails and handrails), as detailed on the Drawings. Connections and sizing to conform to engineering and code requirements specified herein above.
- D. Egress Control Gate (Stair Number 2, between Levels 2 and 3): Provide egress control gate at egress level landing to prevent egress into basement lower level.
  1. Location: Locate gate at the track leading down from the egress level landing.
  2. Gate Design and Style: Fabricate gates to closely match the style and construction of the stair guardrails.
  3. Gate Swing: Swing gate in the direction of egress.
  4. Gate Configuration: Provide either single or double leaf gates, except as shown on drawings. Provide optimum gate configuration which does not obstruct or impede egress and which does not block doorways and exit ways.
  5. Gate Latching: Not permitted. Provide spring hinges to hold gates closed with a maximum 8 pounds of force. Not more than 8 pounds of force applied at the center of the gate shall be required to open gate in the direction of egress.

6. Gate Bumpers and Stops: Provide resilient bumpers and wall stops at both limits of swing of each gate leaf. Provide bumper to silence gate closing. Provide stop to prevent gate from directly hitting adjacent walls and other obstructions.
  7. Gate Attachment and Capacity: Securely attach gates with heavy duty, but lightly acting, spring hinges. To be acceptable, installed gate shall operate normally with no damage when loaded with a 500 pound live load acting to cause greatest stress.
  8. Sign: On pull side of each gate, provide a 12 inch x 16 inch x 14 gage metal sign plaque painted to match the gate. Provide 0.75 inch high white painted lettering reading "Not An Exit" and "Authorized Persons Only". Attach the sign directly into the gate frame members and additional sign support members so there are no projecting bolts or fasteners which could catch clothing or scratch skin.
- E. Elevator pit ladders: Stringers 1/4-inch by 2 inch flat bar, rungs 3/4 inch diameter solid steel rods. Offset ladder from wall surface by 7 inches to centerline of rungs, with brackets.
1. Fabricate ladders in accordance with OSHA requirements, and ANSI A14.3 standards.
  2. Hot dip galvanized finish assembled elevator pit ladders.
- F. Loading dock edge: 4 by 4 by 3/8 inch hot-dipped galvanized steel angle, for entire length of loading dock, with welded studs, for placement by Section 03 30 00 - CAST-IN-PLACE CONCRETE.
- G. Areaway grating: Provide either Welded Steel Grating or Pressure-Locked Steel Grating fabricated by either pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.
1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    - a. Ohio Gratings Inc., Canton OH.
    - b. McNichols Co., Tampa FL.
    - c. Alabama Metal Industries Corp., Birmingham AL.
  2. Grating characteristics:
    - a. Bearing Bar Spacing: 11/16 inches on center.
    - b. Bearing Bar Depth: 1-1/2 inches.
    - c. Bearing Bar Thickness: 3/16 inch.
    - d. Crossbar Spacing: 4 inches on center.
    - e. Traffic Surface: Plain.
    - f. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. of coated surface.
    - g. Minimum load bearing capacity: 600 pounds per square foot, uniform load, and 1400 pounds concentrated load.
  3. Fabrication: Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Provide intermediate

beam supports and supporting edge angles as required. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.

- a. Provide not less than 4 weld lugs for each grating section composed of rectangular bearing bars  $\frac{3}{16}$  inch or less in thickness and spaced less than  $\frac{11}{16}$  inch on center with each lug shop welded to 3 or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
  - b. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
  - c. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
  - d. Do not notch bearing bars at supports to maintain elevation.
- H. Elevator sump pit grate: Provide either Welded Steel Grating or Pressure-Locked Steel Grating fabricated by either pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.
1. Grating Characteristics:
    - a. Bearing Bar Spacing:  $\frac{15}{16}$  inches on center.
    - b. Bearing Bar Depth: 1 inch.
    - c. Bearing Bar Thickness:  $\frac{3}{16}$  inch.
    - d. Crossbar Spacing: 4 inches on center.
    - e. Traffic Surface: Plain.
    - f. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. of coated surface.
  2. Perimeter support angles: Hot dipped galvanized steel, size as indicated on Drawings, furnished to Section 03 30 00 for embedment into concrete.
- I. Elevator sill support angles: 4 by 4 inch by  $\frac{3}{8}$  inch thick, shop primed.
- J. Lintels: As scheduled on Structural Drawings.
1. Provide lintels 12 inches longer than masonry openings. Where lintel abuts column, provide structural clip connection.
  2. Lintels occurring in exterior walls shall be galvanized in conformance with the requirements of ASTM A 143, and ASTM A 123.

End of Section

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Section 05 52 00

MISCELLANEOUS SITE METAL FABRICATIONS

**PART 1 - GENERAL**

1.1 GENERAL

- A. Requirements set forth herein are in addition to and shall be considered as complementary to the Terms and Conditions for Construction and the balance of Divisions 00 and 01 and Technical Specifications.
- B. All Contractors, Subcontractors, Vendors and the like shall be required to familiarize themselves with said provisions.

1.2 SUMMARY

- A. The work of this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all miscellaneous metal work for this project as required by the schedules, keynotes and drawings, including, but not limited to the following items:
  - 1. General material requirements applicable to other Sections
  - 2. Fabrication of copper alloy as handrails: castings, tube, pipe, plate and bar stock as indicated
  - 3. Galvanized steel for backup, anchorage, and all appurtenances as indicated.
  - 4. Metallic finishes
  - 5. Galvanizing
  - 6. Miscellaneous galvanized steel hardware, anchors and pins
  - 7. Nylon insulation to prevent bimetallic reaction
- B. Specific site metal items fabricated under the work of this Section include but are not limited to the following:
- C. The following sections include work related to this Section:
  - 1. Section 033001 Cast-in-Place Concrete - Site
  - 2. Section 042500 Site Unit Masonry
  - 3. Section 323000 Site Furnishings

1.3 REFERENCES

- A. The following standards shall apply to the work of this Section:
  - 1. New York State Department of Transportation - Standard Specifications, Construction and Materials current edition.
  - 2. ASTM: American Society for Testing and Materials
    - a. A36 Carbon Structural Steel
    - b. A48 Gray Iron Castings
    - c. A53 Pipe, Steel, Black and Hot-dipped, Zinc-coated
    - d. A108 Steel Bars, Carbon cold Finished, Standard Quantity

- e. A123 Zinc (Hot-dip galvanized) Coatings on Iron and Steel Products
  - f. A153 Zinc Coating (Hot-dip) on Iron and Steel Hardware
  - g. A307 Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength
  - h. A312 Seamless and Welded Austenitic Stainless Steel Pipes
  - i. A385 Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
  - j. A500 Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
  - k. A510 Wire rods and coarse Round Wire, Carbon Steel
  - l. A781M-16 Standard Specification for Casting, Steel and Alloy, Common Requirements, for General Industrial Use
  - m. A1085 Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)
- 3. AISI: American Iron and Steel Institute
    - a. AISI M1020 Merchant Quality Steel
    - b. AISI BS 1449 Part 4, Standard Mill Surface Finished
  - 4. AWS: American Welding Society
    - a. D1.1 Structural Welding Code – Steel
  - 5. 2015 IBC (2015 International Building Code), Chapter 16 Structural Design by the International Code Council, Article 1607.8.1 Handrails and Guards, and all reference publications, including, but not limited to:
  - 6. ASCE 7 (American Society of Civil Engineers): Minimum Design Loads for Buildings and Other Structures, 49 CFR 193.2013, Section 4.4.2 Loads.
  - 7. Unified Numbering System (UNS) Standard Designation for Wrought and Cast Copper. Specific designation carried in body of this Section.
  - 8. Copper Development Association, Inc. publication A4050-04/16, Copper in Architecture Design Handbook
  - 9. Copper Development Association, Inc. "Copper in Architecture" handbook
  - 10. NAAMM Metal Finishes Manual, Chapter 2 "Finishes for the Copper Alloys", National Association of Architectural Metal Manufacturers, AMP 500-06, 2006

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Design Standards: Comply with the following as applicable:
  - 1. Governing building codes.
- B. Performance Requirements:
  - 1. System shall accommodate movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects when subjected to seasonal temperature changes and live loads.
  - 2. Design system capable of withstanding building code requirements for negative wind pressure.

#### 1.5 ACTION SUBMITTALS

- A. Product literature:
  - 1. Copper and copper alloys proposed for use, including UNS code and Copper Development Association, Inc. Properties of Wrought and Cast Copper Alloys
- B. Shop Drawings:

1. Submit complete shop drawings, including plans, sections and details as required to show all materials, layout, dimensions, jointing and connections for all items required. Shop drawings required include the following:
    - a. Handrails – Copper Alloy
    - b. Guardrails – Copper Alloy
    - c. Stainless steel pins, dowels and anchors
  2. Shop drawings for metal items requiring accurate dimensional relationships to renovated historic items, newly built or as-built construction, shall be prepared following a review and confirmation of the specific site condition or item to match. Provide same for existing or as-built measurements and conditions for areas scheduled to receive miscellaneous metal items by the installer.
  3. Provide stamp and signature of New York registered Professional Engineer on all Shop Drawings of rails and handrails, all locations. Submit and provide same for all calculations and calculation sheets for structural analysis of rails and handrails as described in detail elsewhere in this Section.
- C. Constructed Samples:
1. Samples of handrail:
    - a. Sample of Copper Alloy Handrail shall include half-length of post, shoe, rail components and brace or brackets to 24-inch length, showing attachment system. Samples shall indicate quality of metallurgical attachments proposed for acceptance.
  2. Finishing Sample for Copper and Copper Alloys: provide 12-inch samples of all copper and copper alloys proposed for use in fabricating items in this Section, showing proposed finish and accelerated color, showing similarities and contrasts in color and texture by alloy. The goal of this submittal process is to select the accelerated surface color best suited to all copper alloys and to ensure copper alloys in close proximity have similar surface texture and patinas.
- D. Construction Mockup:
1. Mockup of approved samples installed in accordance with Section 033000 Cast-in-Place Concrete
  2. Mockup of approved samples installed in accordance with Section 323000 Site Furnishings
  3. Mockup of approved samples installed in accordance with Section 042500 Site Unit Masonry
- E. Design Calculations:
1. Submit design calculation by licensed Professional Engineer verifying guardrails and handrails meet referenced load requirements.
  2. Where design is required under this Section, submit design calculations for all pieces with shop drawings to the Owner's Representative before production.
  3. Submit calculations for each miscellaneous structural metal fabrication called for on the Drawings and all related supports and connections. Design of miscellaneous structural metal fabrications shall be under the direct supervision of a Professional Engineer registered in New York; calculations shall bear their seal and signature.
- F. Finish Schedule
1. The Contractor shall submit a complete and detailed finish schedule for all finish treatments provided as work under this Section.

- G. Guarantee
  - 1. Written guarantee as specified in this Section.

#### 1.6 QUALITY ASSURANCE

- A. Structural Engineering Design Services:
  - 1. Contractor, sub-contractor and fabricator shall provide structural engineering calculations to verify guardrails and handrails.
  - 2. Structural Engineer performing the calculations shall be a Professional Engineer licensed by the Division of Professional Licensure, Office of Consumer Affairs and Business Regulation, Commonwealth of Massachusetts. Submit name and contact information for Professional Engineer, including Massachusetts License Numbers, Types of License, Expiration Dates, contact addresses and telephone numbers.
  - 3. The Contractor shall employ and pay all costs for the Structural Engineer to provide structural engineering services to verify guardrails and handrails meet reference loading requirements. In the event that the structural engineering services and loading calculations and analysis determines the proposed design does not meet loading requirements then Structural Engineer shall provide design services to determine component sizing to meet structural loading requirements.
- B. The current issue of Standard Code of Arc and Gas Welding in Building Construction shall apply to this Section as though written out in full. Welding shall be in accordance with the Structural Welding Code of the American Welding Society.
- C. Copper and Copper Alloy Metals:
  - a. All fabricated copper and copper alloy items shall have smooth finish surfaces, stable and color consistent with approved standard color.
- D. Stainless Steel
  - a. All surfaces and connections of stainless steel items shall be without visible grinding marks, surface differentiation or variation.
  - b. All welds on stainless steel components shall be ground smooth and set flush with base metal.
  - c. Stainless steel surfaces shall be clean and smooth.
  - d. Stainless steel plate and sheet shall be free of dimpling, buckling, 'oil canning' and similar distortions cause by welding of the plate or sheet material.
- E. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store work as specified under this Section 055200 in a manner to prevent damage to surface finishes of metal items, wracking or stress of components, and to prevent mechanical damage or damage by the elements. All stored materials and items shall be protected from weather, careless handling and vandalism.
- B. Items which become rusted or damaged because of non-compliance with these conditions will be rejected and shall be replaced without additional cost to the Owner.

- C. Items that oxidize unevenly or become damaged because of non-compliance with these conditions will be rejected and shall be replaced without additional cost to the Owner.
- D. Deliver work to the site in sufficient time to avoid delay in job progress and at such times as to permit proper coordination of the various parts. The Contractor shall be responsible for scheduling the delivery of all items so as to minimize on-site storage time prior to installation.
- E. Deliver bolts and other small items required for erection of work under this Section bundled with their respective items. Metal items that are fabricated and galvanized under this Section and require powder coatings shall be surface prepared and primed within 12 hours of the paint manufacturer's recommendations.

#### 1.8 COORDINATION

- A. The work of this Section shall be completely coordinated with the work of other Sections. Verify dimensions and work of other trades which adjoin materials of this Section before installing items specified.
- B. Obtain all necessary templates and patterns required from other trades for proper execution of work of this Section. Furnish to other trades items to be built into work of other Sections. Supervise installation of such built-in work.

#### 1.9 GUARANTEE

- A. Furnish written guarantee in Owner's name covering all materials and workmanship under this Section, in addition to, and not in lieu of, guarantee requirements set forth under Division 1 Specification Sections, and other liabilities which the Contractor may have by law or other provisions of the Contract Documents.
- B. Pay for repairs of any damage to any part of the project caused by defects in workmanship and installation. Pay for any repairs to materials or equipment caused by replacement. All repairs shall to be done to the satisfaction of the Owner's Representative.
- C. Any part of the work installed under this contract requiring excessive maintenance will be considered as being defective. Replace defective items during the one year guarantee period at no cost to the Owner.

### PART 2 - PRODUCTS

#### 2.1 MATERIAL REQUIREMENTS

- A. Furnish all supplemental parts necessary to complete each item whether or not such parts are shown or specified. Furnish all fastenings for securing the work required in this Section 055200 Miscellaneous Site Metals, to the work of other trades. Furnish, deliver, and pay for the costs of furnishing and delivery under the work of this Section 055200. Installation of all fastening devices on the job site shall be paid for under the work of other Sections.
- B. Provide only new materials, free from defects impairing strength, durability or appearance and of the quality specified.
- C. Standard products meeting the detailed requirements specified in this Section will be considered for approval by the Landscape Architect.

- D. Furnish all supplemental parts necessary to complete each item whether or not such parts are shown or specified. Furnish all fastenings for securing the work required in this Section to the work of other trades. Furnish, deliver, and pay for the costs of furnishing and delivery under the work of this Section.
- E. Provide fastenings of the same material, color and finish as the metal to which applied unless otherwise indicated.

## 2.2 METALS

### A. Steel:

- 1. ASTM A36/GR50 requirements for flat bar and angle stock.
- 2. ASTM A53, Type F for straight steel pipe. Schedule 40 wall thickness.
- 3. ASTM A53, Type E, Grade B schedule 40 for steel pipe formed with bends or curves shall be circular steel pipe in accordance with. Sizes and bends are as shown on the Contract Documents
- 4. ASTM A283, Grade C for steel plates, remaining flat, to be bent or cold formed
- 5. ASTM A500 Grade B for steel tubing, round, rectangular and square. Steel sections for tubing shall be one-quarter inch wall thickness. Provide tubing with sharp, 90-degree corners.
- 6. ASTM A1085 for hollow structural square and rectangular tubing. Provide tubing with sharp 90-degree edges. Rolled edges are not acceptable. Steel sections for square and rectangular tubing shall be one-quarter inch wall thickness.
- 7. All steel sections shall be fillet welded and ground smooth prior to galvanizing, and priming and shop painting, to the sizes and dimensions as shown on Contract Documents.
- 8. All hardware shall conform to ASTM A307 requirements and galvanized in accordance with Section A153.

### B. Copper Alloys: in accordance with Copper Development Association, Inc. publication Copper in Architecture.

- 1. C26000 Cartridge Brass Group. The following alloy grouping is selected for similar finish:
  - a. For Handrail
    - 1) Sheet and Plate: C26000
    - 2) Extrusions: C26000
    - 3) Castings: C85200, C85300
    - 4) Fasteners: C26000, C36000, C46000, C46500, C48600
    - 5) Round Bar: C36000
    - 6) Tube: C26000
    - 7) Rod and Wire: C26000
    - 8) Filler Metals: C68100
- 2. Handrailing products by Julius Blum & Co. Inc.
  - 1) Post tubing for handrails as indicated on the detailed drawings:
    - a) 1.5-inch x 1.5-inch OD x 0.100-inch wall seamless tube.
  - 2) Channel for handrail as indicated on detailed drawings:
    - a) 1.25-inch x 0.625-inch x 0.125-inch
  - 3) Handrail profile as indicated on detailed drawings:
    - a) Model #4530 Bronze
  - 4) Post base cover has a square hole, model 269 - bronze, as manufactured by Julius Blum Model Co.
  - 5) Railing vertical terminuses shall be model 4530-S, Straight Lamb's Tongue as manufactured by Julius Blum.

- 6) Left channel lateral scroll shall be model 4530-CL, as manufactured by Julius Blum.
- 7) Left lateral scroll moulding shall be model 4530-GL, as manufactured by Julius Blum.
- 8) Right channel lateral scroll shall be model 4530-CR, as manufactured by Julius Blum.
- 9) Right lateral scroll moulding shall be model 4530-GR, as manufactured by Julius Blum.

C. Cast Iron:

1. Cast iron shall conform to ASTM A48 Class 35A for cast gray iron. Cast components shall have surfaces free from injurious defects and burnt-on sand, and shall be reasonably smooth, all in conformance with industry standards for "Ornamental Castings". Runners, risers, fins and other cast-on variations from the design shall be removed by grinding followed by shot-blasting, except that in no case shall striations caused by grinding be visible nor shall projections be removed closer than 3/32 inches above the cast surface as drawn. Repairs made by welding to restore the thickness or surface relief of the casting will not be permitted.

## 2.3 SURFACE TEXTURES AND FINISH

A. Copper alloy materials:

1. Non-directionally textured, M42 fine matte, in accordance with NAAMM Metal Finishes Manual.
2. Conversion Coating for Handrail: Chemically weathered to create a uniform brown color, C55 Sulfide (statuary), in accordance with NAAMM Metal Finishes Manual.
3. Owner's Representative's expectation for color rendition of copper allows are described in Copper Development Association, Inc. publication Copper in Architecture, Table 3.5A Sulfide "Statuary" Medium (C-55) or Sulfide "Statuary"
4. Dark (C-55) for C26000 Cartridge Brass and Patinated (C-52) for specified coppers based on color samples for review and acceptance by Owner's Representative.
5. Owner's Representative's expectation for color rendition of copper for Handrail are described in Copper Development Association, Inc. publication Copper Brass Bronze Design Handbook, Architectural Applications, Figure VI-15, untreated. Apply no stabilizing sealant or oils to Handrail items
6. Solder: ASTM B32; Provide 50-50 tin/lead or lead free alternative of similar or greater strength solder. Killed acid flux.
7. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.
8. Provide non-directional textured surfaces and conversion coating for FUR06a Handrail

B. Stainless Steel Finish for hidden from view elements and furnishings:

1. Hot-rolled or cold-rolled, annealed, abrasive blast cleaned with a dull, gray appearance. After rolling, the steel is heat treated to produce a uniform microstructure (annealing). Blast clean to remove scale.

## 2.4 GALVANIZING

A. All steel elements to be galvanized shall conform to the following specifications.

- B. Prior to galvanizing, all specified metal items shall be cleaned (pickled) in accordance with SSPC-SP8. Cleaning shall remove all rust, scale, and coating surface must be clean, dry, undamaged and free of all loose rust, dirt, grease, or other contaminants including salt deposits. Specified

metal items calling for galvanizing shall be hot-dipped galvanized after fabrication and chromated after galvanizing by dipping in a 0.15 percent chromic acid solution. Galvanizing bath shall contain 0.05 – 0.09 percent nickel. Galvanize all ferrous fasteners, clips, sleeves, anchors and accessories in contact with galvanized items.

- C. Galvanizing shall comply with ASTM A123, A153 and A385 as applicable.
- D. All galvanized materials shall be inspected for compliance with these specifications and marked with a stamp indicating the name of the galvanizer, the ASTM Specification and the weight of the zinc coating in ounces per square foot.
- E. Unless otherwise indicated, all items to be galvanized under this Section shall receive a 3 mil coating of zinc.
- F. Items to be galvanized shall be galvanized after fabrication. Where size of assembly is too large for complete unit galvanizing, these assemblies shall be galvanized prior to fabrication, in as large sections as practical and then only with the written approval of the Owner's Representative.
- G. Touch-Up and Repair: For damaged and field welded zinc-coated surfaces, clean welds, bolted connections and abraded areas. At galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A780. Thickness of applied galvanizing repair paint shall be not less than coating thickness required by ASTM A123 or A153 as applicable.
- H. Following galvanizing, each item shall receive surface grinding to remove lumps, sags or spikes resultant from the galvanizing process. The finished surface following grinding shall be hand smooth and without irregularities. Take care not to damage the galvanized surface coating.
- I. Coordinate galvanizing and shipping of site metal items with the requirements for painting of metal items as noted in Section 09 9113 Exterior Painting, of this Specification. Metal items that are fabricated and galvanized under this Section 055200, shall be prime painted within 12 hours of the specified surface preparation.

## 2.5 INSULATION BUSHINGS, PLATES, SHIMS

- A. Insulation bushings, plates, shims and other miscellaneous shapes to prevent bi-metallic reaction between aluminum, stainless steel, ferrous metals and galvanized steel hardware and base metals shall be fabricated from Nylon. Sizes and shapes as shown on the Detailed Drawings or as required to fit field conditions to prevent corrosion.

## PART 3 - EXECUTION

### 3.1 COORDINATION

- A. Fabricators producing precast concrete and site furnishings materials and components as specified in other Sections shall utilize the material standards and fabrication requirements specified in this Section 055200 for the fabrication of metal components utilized in the precast concrete and site furnishing products specified in other Sections.

### 3.2 GUARDRAIL AND HANDRAIL DESIGN CALCULATIONS



- A. Contractor, Sub-contractor and Fabricator shall secure services of licensed structural engineer to develop design calculation for guardrails and handrails to verify rails conform to loading requirements of 2015 IBC Article 1607.8.1 and ASCE 7 Section 4.4.2 Loads.
- B. In addition, confirm handrails and guardrails will deflect no more than 1/4-inch in lateral movement with specified weight loading identified in reference 2015 IBC and ASCE 7 codes.
- C. If rails do not conform to 2015 IBC or ASCE 7 loading standards then indicate sizing of guardrail and handrail components that will, when assembled into railing systems meeting general design intent, meet reference loading requirements.

### 3.3 METAL FABRICATION – GALVANIZED STEEL REQUIREMENTS

- A. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code—Steel."
  - 2. AWS D1.3, "Structural Welding Code—Sheet Steel."
  - 3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- B. Where structural joints are made by welding, the details of all joints and techniques of welding employed, the appearance and quality of welds made, and the methods used to correct defective work shall conform to requirements of the AISC and AWS codes.
- C. Welds shall be made only by welders who have previously been qualified by tests as prescribed in AWS "Standard Qualification Procedure" for the type of work required.
- D. All dissimilar metals shall be insulated from one another to prevent bimetallic interaction.

### 3.4 METAL FABRICATION – COPPER ALLOY REQUIREMENTS

- A. Take all measurements required at the work site. Check measurements, compare dimensions and other data with various trades installing adjoining work to assure proper coordination.
- B. Fabricate copper alloy metal handrails such that horizontal elements are level, vertical elements plumb and rails over steps follow grading of nosing as shown.
- C. Do all shop drilling, fitting, cutting, bending, welding, grinding, finishing and chemical coloring required to fabricate, fit and install handrails in designated locations. Furnish all anchors required to attach copper alloy metal work securely to concrete, masonry or stone substrates as indicated and as directed by the Owner's Representative.
- D. Fabricate handrails without visible welds. Bending shall performed at either ambient or elevated temperatures. Fabricate accurate bends to the radii shown, using rollers, guides, bending shoes or mandrels to avoid buckling or non-uniform deformations.
- E. Metallurgical Jointing Processes: Welding by Oxy fuel, GMAW (Gas Metal Arc Welding), GTAW (Gas Tungsten Arc Welding), spot resistance and butt resistance as applicable and approved by the Owner's Representative. Welding shall be continuous except where tack welding is required for ease of fitting and fabrication. All exposed welds shall be ground smooth and finished as specified in this Section.

- F. Do not enlarge unfair holes by burning and forcing, but correct by reaming.

### 3.5 STAINLESS STEEL WELDING PROCEDURES

- A. Pre-weld Cleaning:
  - 1. Clean surfaces to be joined and adjacent surfaces for at least 1 in. on each side of the weld centerline.
  - 2. Remove all contaminants such as cutting fluids, oil, waxes, oxides, skin oils, organic residues, etc.
  - 3. Acceptable Cleaning Methods: Nonmetallic brushes and solvents.
- B. General Welding Procedure: Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base materials.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding fume and residue immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface approximately matches that of adjacent surface.
- C. Use Gas Tungsten Arc Welding procedure in compliance with AWS D1.6 with 98% argon – 2% oxygen mix as shielding gas.
  - 1. Fit up parts in proper alignment with stainless steel or nonferrous jigs and alignment hardware.
  - 2. Install appropriate wind shields to ensure that the weld shielding gas is not disturbed by the conditions on the roof, such as wind, dust, etc.
  - 3. Mask both sides of joint against weld splatter or apply anti-splatter compound.
  - 4. Gas Shielding: Inert gases 98% argon and 2% oxygen, no CO<sub>2</sub>. Maintain shielding as required to prevent oxidation of weldment as it cools.
  - 5. Welds produced must show complete fusion of the base metal sheets on both sides of the joint without undercutting.
- D. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
- E. Select and adjust the remaining welding parameters according to recommendations from manufacturer of welding equipment and to ensure complete fusion of the base metal without undercutting or other welding defects.
- F. Post-weld Cleaning: After welding, clean exposed metal surfaces, removing welding fumes and other substances that might cause corrosion of metal or deterioration of finishes. Clean all welds using acid descaling, pickling, as per recommendations in ASTM A380. No wire brushing.
- G. Provide post-weld chemical or heat treatments of exposed to view surfaces to remove signs of welding and heat treatment.

3.6 WORKMANSHIP

- A. Workmanship and finish shall be equal to the best practice of modern shops for each item of work. Metal fabrication shall be accomplished using the highest standards of workmanship. All work shall be executed by experienced metal workers, shall conform to the requirements of the Contract Documents, and meet the following requirements.
1. General:
    - a. Individual metal pieces shall be saw cut and carefully fitted together.
    - b. Sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to curves.
    - c. Fabricated items shall show metal pieces that are accurately saw cut and are fitted together without gaps, spaces, voids, breaks and crooks in arriss lines, humps, bumps, sags and saddles.
    - d. Horizontal and vertical curves shall meet the shapes and profiles shown on the Contract Documents. Curves shall be free of broken backs, sags, saddles, tangents or kinks.
    - e. Exposed surfaces shall have a smooth finish and sharp, well defined lines and arrises.
    - f. Grind all edges of bars and plates completely free from nicks and machine marks, prior to galvanizing or shop priming.
    - g. All surfaces and connections of metal items shall be without visible grinding marks, surface differentiation or variation.
    - h. Castings shall have sharp corners and edges and shall be clean, smooth and true to pattern.
    - i. Welding shall be continuous and shall extend for the entire length of the joints except where specifically indicated on the Contract Documents. All exposed welds shall be ground smooth.
    - j. All fabricated metal items shall be fine sanded throughout to produce a high standard of surface smoothness.
    - k. Square and rectangular steel tubing shall have sharp 90 degree corners and edges. Metal furnishings with rounded corners and edges arriving to the Project site or having been installed on the Project site will be rejected, removed and discarded. Replacement of all metal furnishings so rejected shall be entirely at the Contractor's expense.
    - l. Weld with uncoated wire to prevent flux deposits. If coated wire is used, all flux residue shall be thoroughly removed and bare white metal exposed, prior to galvanization, if applicable. Where overlapping surfaces are welded, seal off contact area by welding all edges around contact area.
    - m. All welds shall be water tight.
    - n. Nylon insulating pads, bushings and washers used to prevent bimetallic reaction at all locations where dissimilar metals come into contact.
    - o. All shop connections shall be full seam welded and ground flush and smooth. Field connections bolted unless otherwise permitted as indicated in this Section. Draw up all threaded connections tightly, after buttering same with pipe joint compound, to exclude water. Deform threads to prevent loosening for all exposed connections subject to vandalism.
    - p. Inspect all components prior to galvanizing to verify all welds are sound and steel has sufficient integrity to be galvanized.
    - q. Field connections bolted unless otherwise permitted as indicated in this Section. Draw up all threaded connections tightly, after buttering same with pipe joint compound, to exclude water. Deform threads to prevent loosening for all exposed connections subject to vandalism.
  2. Acceptance standards for fabricated miscellaneous site metal items:

- a. Where any of the workmanship standards are not met the Owner's Representative will inspect the extent of failure to meet standards and will determine whether the metal items are acceptable.
  - b. The determination of the Owner's Representative will be final.
  - c. Inspection may occur at the source of fabrication, following delivery of the metal items to the Project site or after installation.
  - d. Remove and discard sub-standard metal items at no additional cost to the Owner. Replace sub-standard metal items with newly fabricated, delivered and installed site metal items that meet the requirements of this Article without additional cost to the Owner.
- B. Where the work of this Section must be attached to other materials or where it must be assembled and installed in the field, Contractor shall cut, drill, punch and ream, countersink and tap, or otherwise provide the required holes in the shop, unless such connections are to be welded. The sizes and locations of all such holes shall be shown on the Shop drawings.
- C. Metalwork to be built in with concrete or masonry shall be of the form required for anchorage or shall be provided with suitable anchors or expansion shields.
- D. All materials and workmanship under this Section shall be subject to inspection in the mill, shop or field by the Owner's Representative, or by qualified inspectors retained by the Owner. Inspection shall be without expense to the Contractor. However, such inspection, wherever conducted, shall not relieve Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements.
- E. Take all measurements required at the work site. Check measurements, compare dimensions and other data with various trades installing adjoining work to assure proper coordination.
- F. Fabricate metal items such that elements are level and plumb or as shown.
- G. Fabricate metal items with blow holes to insure galvanizing inside of pipe and tube stock. Fill after galvanizing with approved body filler and grind smooth prior to applying paint coating.
- H. Do all shop drilling, tapping, shop fitting, shop cutting, shop welding, and bolting required to erect, install and fit metal work to adjoining work. Conform to AISI Code for Steel or Stainless Steel as applicable. Furnish all screws, bolts, anchors, etc., required to attach metal work securely to adjoining work.
- I. Where steel tubing or pipe is to be galvanized after assembly and welding, provide blow holes for full flow of zinc into the interior of tube or pipe. After galvanizing weld the blow holes closed, grind smooth and paint with zinc rich primer.
- J. Utilize plug welds, interior pipe and tube welding through access holes, welding on the underside of channel stock and similar devices to conceal all welds from view. Intersections of all component parts shall appear crisp and clean without welding or grinding. Fill access holes after welded with filler metal and grind smooth and invisible from distance of 5-feet. Utilize plug welds ground smooth. All strategies for fabrication and joining of metal parts shall lead to railing assemblies without external welds or visible grind marks.
- K. Steel items shall be fabricated so that there are no visible welds. Utilize plug welds, interior pipe and tube welding through access holes, welding on the underside of channel stock and similar devices to conceal all welds from view. Intersections of all component parts shall appear crisp and clean without welding or grinding. Fill access holes after welded with filler metal and grind

smooth and invisible from distance of 5-feet. Utilize plug welds ground smooth. All strategies for fabrication and joining of metal parts shall lead to railing assemblies without external welds or visible grind marks.

- L. Do not enlarge unfair holes by burning and forcing, but correct by reaming.
- M. Install all supports and anchors for metal work except those to be cast into concrete or built into masonry as shown.
- N. Furnish all required metal inserts, anchor slots, anchors, anchor bolts, fastenings, etc., for attachment of work of all trades to Cast-in-Place Concrete and Unit Masonry, except where otherwise specified or obviously included under other Sections of the Specifications.
- O. Weld with uncoated wire to prevent flux deposits. If coated wire is used, all flux residue shall be thoroughly removed and bare white metal exposed. Where overlapping surfaces are welded, seal off contact area by welding all edges around contact area.
- P. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

### 3.7 EXAMINATION

- A. Examine the site, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Install metal items only after verification that as-built field dimensions are accurate. Notify the Owner's Representative when field conditions are not suitable for installation of fabricated metal items. Proceed with installation of fabricated metal items only after unsatisfactory conditions have been corrected.

### 3.8 INSTALLATION

- A. All metal items fabricated under this Section shall be transported to the construction site and installed under the work of Section 033000 Cast-in-Place Concrete -Site, Sections 042500 Site Unit Masonry, and Section 323000 Site Furnishings and all other work as required by these Specifications.

END OF SECTION 055200

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Section 05 70 13  
DECORATIVE METALS – BRASS/BRONZE

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.
- C. therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
  - 1. Bronze handrails and guards, with supports and pickets.
    - a. Exterior Monumental stair railings.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 04 92 00 - STONE MASONRY RESTORATION.
- D. Section 05 50 00 - METAL FABRICATIONS.
- E. Section 05 52 00 - MISCELLANEOUS SITE METAL.
- F. Section 06 40 00 – ARCHITECTURAL WOODWORK.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM B134 - Specification for Brass Wire.
  - 2. ASTM B135 - Specification for Seamless Brass tube.
  - 3. ASTM B36 - Specification for Brass Plate, Sheet, Strip and Rolled Bar.
  - 4. ASTM B455 Specification for Copper Zinc Lead Alloy (Leaded Brass) Extruded Shapes.
  - 5. ASTM B584 - Specification for Copper Alloy Sand Castings for General Applications.

6. FS QQ-R-571 - Rod Welding Copper and Nickel Alloy
7. CDA - Standards Handbook, Wrought Copper and Copper Alloy Mill Products, Part 2 - Alloy Data.
8. CDA - Standards Handbook, Cast Copper and Copper Alloy Mill Products, Part 7 - Alloy Data.
9. CDA - Brass and Bronze Design Handbook for Architectural Applications.
10. NAAMM publication AMP 500 – Metal Finishes Manual.

#### 1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  1. Shop drawings: Include large scale details of items of handrail brackets to be furnished hereunder, showing proposed methods of anchorage to surrounding structure and conditions.

#### 1.6 QUALIFICATIONS

- A. Fabricator, with a minimum of 5 years documented experience demonstrating previously successful work of the type specified herein.

#### 1.7 COORDINATION

- A. Be responsible for establishing locations and levels for all work of this Section, except such parts as may be delivered to others and set by them. In such cases assist them in properly locating said parts.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. All materials under this Section shall be carefully prepared for delivery, and handled and stored under cover in a manner to prevent defacement, deformation, or other damage to the materials and to shop finishes, and to prevent the accumulation of foreign matter on the metal work. All such work shall be repaired and cleaned prior to erection.

### **PART 2 - PRODUCTS**

#### 2.1 FABRICATORS

- A. Fabricators offering products which may be incorporated in the work include, the following:
  1. Astec-USA, Brooklyn NY..
  2. Historical Arts and Castings, Inc, West Jordan, UT.
  3. Les Métalliers Champenois (LMC Corporation), Paterson NJ.
  4. Tate Ornamental Inc., White House TN.
  5. Mac Metals, Kearny, NJ.
  6. Lee Quigley Company, Alexandria, VA.



## 2.2 MATERIALS

- A. All materials shall be new stock, free from defects impairing strength, durability or appearance, and of best commercial quality for each intended purpose. Unless specifically called for otherwise, work shall be fabricated from the following:
  - 1. Extrusions CDA 385 (Architectural Bronze) conforming to ASTM B455.
  - 2. Sheet/plate Alloy 230 red brass 85% conforming to ASTM B36
  - 3. Bar stock Alloy 230 red brass 85% conforming to ASTM B36
  - 4. Castings Alloy 836 conforming to ASTM B584.
  - 5. Concealed Fasteners Alloy 651, Low Silicon Bronze.
  - 6. Exposed Fasteners 280, Muntz metal.
  - 7. Tubing Alloy 230 red brass 85%, conforming to ASTM B135.
  - 8. Wire Alloy 230 red brass 85%, conforming to ASTM B134.
  - 9. Filler Alloy 655 High Silicone Bronze conforming to FS QQ-R-571.
- B. Provide all fasteners and attachments of the same material and finish as the metal to which it is applied unless otherwise noted. Provide all fasteners and attachments as required for work specified herein and as indicated on the Drawings.

## 2.3 FABRICATION - GENERAL

- A. Metal surfaces shall be clean and free from mill scale, flake, and pitting; well formed and finished to shape and size, true to details with straight, sharp lines, and angles and smooth surfaces. Curved work shall be to true radii. Exposed sheared edges shall be eased.
- B. Shop braze or solder all concealed permanent connections. Grind all exposed-to-view brazed and soldered joints completely smooth and flush to the surface plane of the base metals.
- C. Shop fabricate items wherever practicable, accurately fitting all parts and making all joints tight. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- D. Do all cutting, punching, drilling, and tapping required for attachment of anchor bolts and other hardware and for attachment of work by other trades.
- E. Use screws and bolts of sufficient size to ensure against loosening from normal usage of ornamental metal items furnished hereunder.
  - 1. Countersink all screw heads and bolt heads as far as practicable. Use not less than two screw, bolts, or other anchorage items, at each connection point.
  - 2. Draw up all threaded connections tightly, after buttering same with pipe joint compound, to exclude water.

## 2.4 FABRICATION - RAILINGS (HANDRAILS/GUARDRAILS)

- A. Refer to the Drawings for location and details of steel railings to be furnished and installed hereunder.
  - 1. Verify heights shown in Drawings comply with referenced codes and regulations.

- B. Railing performance requirements; conform to all requirements of those codes and regulations referenced under Section 01 41 00 - REGULATORY REQUIREMENTS.
  - 1. Design, fabricate and install all railings in a manner which will ensure the railings will be capable of withstanding loads as follows, required by the International Building Code, Section 1607.
    - a. Resist a load of 50 pounds per linear foot (0.73 kN/m) applied in any direction at the top and to transfer load through railing supports to structure.
    - b. Resist a single concentrated load of 200 pounds (0.89kN) applied in any direction at any point along the top, and to transfer load through railing supports to structure.
    - c. Intermediate rails, balusters and panel fillers shall resist a horizontally applied load of 50 pounds (0.89 kN) on an area equal to 1 square foot (.093m<sup>2</sup>), including openings and space between rails.
- C. Fabrication, Railings: Fabricate to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads and deflection criteria. Indicate on shop drawings sizes of all members, gages and configurations of handrails, and guardrails.
  - 1. Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
    - a. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
  - 2. Form changes in direction of railings as indicated on drawings, with radius bends of radius indicated. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
  - 3. Close exposed ends of railing members with prefabricated end fittings.
  - 4. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
  - 5. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
    - a. Connect posts to stair framing by direct welding unless otherwise indicated.

## 2.5 FINISHES

- A. Finishes: NAAMA finish M32 - Medium satin finish, directional textured, matching Architect's control sample, top-coated with two coats clear organic solvent-based lacquer equal to Incralac, or Permalac.

### **PART 3 - EXECUTION**

#### **3.1 ERECTION**

- A. Accurately set all work to established lines and elevations, and rigidly fasten in place with suitable attachments to the construction of the building. At the completion of the work, check all work, re-adjust as required, and leave in perfect condition. Grind all exposed to view welds smooth to the touch.
- B. Construct and install stairs in strict accordance with the details, the approved shop drawings, and requirements of all codes, laws, and ordinances bearing on the work.

#### **2.2 FIELD BOLTING**

- A. Accurately drive all bolts into holes, protecting the bolt heads so as not to damage the thread during the driving. Ensure that bolt heads and nuts rest squarely against the metal. Where structural members have sloping flange faces, provide approved beveled washers at the bolted connections to afford square seating for bolt heads or nuts.

End of Section

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Section 06 10 00  
ROUGH CARPENTRY

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Fire retardant treated plywood backer panels for mounting of electrical panelboards, audio/visual controls, telephone/data backboards, HVAC and fire control equipment and other equipment.
  - 2. Various wood blockings, edgings, nailers, curbs, cants, grounds, furring, sheathing, framing members including wood preservative, as required for receipt of various finishes and surfacing materials, not described herein above.
  - 3. Pressure preservative treated plywood sheathing.
  - 4. Rough installation hardware, including bolts, screws, spikes, nails, clips, and connection assemblies, as needed for installation of the rough carpentry work.
- B. Install the following furnished under the designated Sections:
  - 1. Concealed anchorage devices for handicap handrails in toilet rooms: Section 10 28 13 - TOILET ACCESSORIES.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 20 00 - FINISH CARPENTRY: Wood trim.
- D. Section 06 40 00 - ARCHITECTURAL WOODWORK.
- E. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing hollow metal framing.
- F. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work.
- G. Section 09 29 00 - GYPSUM BOARD: Wall board construction work, having taped and compounded joint finish.

- H. Section 09 91 00 - PAINTING: Applied primer and finish coatings to exposed to view rough carpentry work.
- I. Section 10 28 13 - TOILET ACCESSORIES: Providing anchorage devices and mounting templates for toilet accessories.
- J. Division 26 - ELECTRICAL: Providing and mounting electrical panels and equipment.

#### 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. APA - applicable grades and specifications.
  - 2. APA PRB-108 Performance Standards and Policies for Structural-Use Panels..
  - 3. ASTM D 3201 - Test Method for Hygroscopic Properties of Fire-Retardant Wood.
  - 4. AWWA Standards and references for preservative treated wood including Standards UC1, UC2, UC3A, UC3B, UC4A, and P5
  - 5. AWWA Standard UCFA – Fire Protection as Required by Codes Above Ground Interior Construction.
  - 6. AWWA Standard UCFB – Fire Protection as Required by Codes Above Ground Exterior Construction.
  - 7. AWWA M4 – Care Of Preservative Treated Wood Products.
  - 8. NER-643: ACQ Preserve® and ACQ Preserve Plus® Wood Preservative Treatment, ICBO Evaluation Service.
  - 9. MIL L-1914OE - Lumber and Plywood, Fire Retardant Treated.
  - 10. SPIB Grading Rules, current edition.
  - 11. UL - Building Materials Directory
  - 12. US. Department of Commerce Voluntary Product Standard PS1 for Construction and Industrial Plywood.
  - 13. US. Department of Commerce Voluntary Product Standard PS2 for Wood-Based Structural-Use Panels.
  - 14. US. Department of Commerce Voluntary Product Standard PS-20 - American Softwood Lumber Standard.
  - 15. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber
  - 16. American Lumber Standards Committee, National Lumber Grades Authority for Canadian Lumber, and applicable grading rules and standards of the various lumber associations whose species are being used for grades specified.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate the work of this Section with the respective trades responsible for locating anchorages installed into blocking which is provided under this Section.
2. Coordinate work of this Section with the work of the various trades responsible for applying finish materials and other items to rough carpentry work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for products specified herein.
  2. Certifications:
    - a. Chain-of-Custody: Written documentation providing evidence of compliance with Chain-of-Custody supply of wood products, and compliance with FSC.
      - 1) Demonstrate that products are FSC-certified by providing vendor invoices. Invoices will contain the vendor's chain of custody number and identify each chain of custody certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.
    - b. Fire-Resistive Treatment: Written certification from the respective treatment plants indicating types of wood preservative treatment and fire-retardant treatment used, treatments method, applications instructions, and conformance to the requirements specified herein.
      - 1) Provide certification that fire retardant treatment materials do not contain ammonium phosphate.
      - 2) Provide report from ICC Evaluation Service on fire retardant treated wood flame spreading, strength, corrosion and hygroscopic properties.
      - 3) Provide report from ICC Evaluation Service on pressure preservative treated wood strength, corrosion, anti-fungi, and anti-insect properties.
    - c. NAUF: Certify that all composite wood and agrifiber products used on this Project are NAUF.
      - 1) Written certification from Millworker, that only "no-added formaldehyde" (NAUF) manufactured composite panel products are to be incorporated into the Work, including all concealed components. NAUF composite panel products include, but are not limited to, particle board (PB), oriented strand board (OSB), and medium density fiberboard (MDF) and similar manufactured products.
  3. LEED Submittal Requirements:
    - a. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:

- 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
  - a) Itemized vendor invoices for FSC-certified products.
  - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
- 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
- b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
  - 1) Recycled Content:
    - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
    - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
  - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
    - a) Documentation should be in the form of one of the following:
    - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
    - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
    - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
    - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
    - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
  - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- c. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;



- Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
- c) Laboratory accreditation under ISO/IEC 17025.
- d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
- 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
- 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (composite wood products):
  - 1) Provide manufacturers' product data confirming that the composite wood products in the building have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for composite wood products installed within the waterproofing membrane.

## 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
  - 1. All lumber shall:
    - a. Be new, dressed four sides (S4S), clear and free from warping and other defects.

- b. Have a moisture content not exceeding 19 percent when delivered to the project.
      - c. Be in accordance with the grading rules of the lumber manufacturer's association under whose jurisdiction the lumber is produced and bear the mark of grade and mill identification.
    - B. Certifications:
      - 1. Plywood: Conform to the requirements of Product Standard PS-1, and bear applicable APA grade trademarks.
        - a. Plywood for electrical boards treated for retardance, meet Class I or a flame spread rating of 25 or less and bear U.L. label "Classified FRS".
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:
  - B. Store all materials in an elevated dry location, protected by waterproof coverings.

## **PART 2 - PRODUCTS**

### 2.1 BOARD AND SHEET MATERIALS

- A. Chain of Custody: All wood products furnished under this Specification Section shall be "FSC Certified" according to the rules of the Forest Stewardship Council (FSC) or "CSA-SFM Certified" according to the rules of Canadian Standards Association International (CSA) Forest Products Group Sustainable Forest Management (SFM) Program.
  - 1. FSC Certification includes the following certification bodies of forests and forest products:
    - a. SCS Global Services.
    - b. SmartWood.
    - c. SGS Qualifor.
    - d. Soil Association.
- B. Lumber for blocking, nailers and curbs as indicated or required: Hem-Fir, Douglas Fir, Eastern Spruce, Eastern Hemlock, or Southern Pine, surfaced dried stud or utility grade. Wood members shall be of sizes indicated on the Drawings or of the same size as the members being braced.
  - 1. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
  - 2. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
- C. Furring: Nominal 1 by 3 inches or 1 by 4 inches Douglas Fir, Eastern Spruce, Eastern Hemlock, or Southern Pine, surfaced dried construction grade.
- D. Plywood and sheet products:
  - 1. Plywood Sheathing (at elevator overruns, dormers and where indicated): APA RATED SHEATHING, 3/4 inch (19.1 mm) thick typical, having a minimum span

rating 48/24 (provide other thicknesses in locations where indicated on Drawings), 5 ply/5 layer plywood touch-sanded, pressure preservative treated.

- a. Oriented Strand Board (OSB) sheathing not acceptable for substitution.
2. Marine grade plywood: EWA MARINE A-A EXT, fir veneer marine grade plywood, with plugged cores and sanded faces .
3. For substrate beneath gypsum board: Square edge APA graded C-D-X EXT, touch-sanded, 1/2 inch thick, except as otherwise indicated on the Drawings
4. For electric panel board mountings and similar uses: APA graded B-D INT, Group 2 species, touch-sanded, fire-retardant treated, 3/4 inch thick, except as otherwise indicated on the Drawings.
5. For unspecified interior concealed from view locations: APA graded C-D PLUGGED INT, Group 2 species, thickness as indicated on the Drawings.

## 2.2 WOOD TREATMENTS

- A. Treated wood products shall be produced by a single treatment plant, fully licensed by the chemical manufacturers, and conforming to the requirements specified herein.
  1. Toxicity and Environmental Quality:
    - a. Products containing chromium will not be permitted.
    - b. Products containing arsenic will not be permitted.
    - c. Fire-retardant-treated wood products shall be free of halogens, sulfates, ammonium phosphate and formaldehyde.
  2. Dye wood or otherwise color code all treated wood at treatment plant to clearly distinguish the different treatments in the field.
  3. Kiln dry all treated lumber and plywood to the following maximum moisture content after treatment.
    - a. Lumber: 19 percent.
    - b. Plywood 15 percent.
    - c. Discard pieces with defects which might impair quality of work.
  4. Quality marks: Each piece of lumber and plywood shall be permanently affixed with a quality mark, containing the following information:
    - a. Identification of the inspection agency.
    - b. Standard to which material was treated.
    - c. Identification of the treating plant.
    - d. Fire retardant treated wood shall include: stamp signifying a FR-S rating
    - e. Preservative treated wood shall include: Retention and end use for which product is suitable.
- B. Fire retardant treated wood. Designated as "FRTW"
  1. Chemical Manufacturer: Subject to compliance with the requirements specified herein, Products which may be incorporated in the work include:
    - a. Arch Wood Protection, Atlanta, GA., product, "Dricon FRT Wood".
    - b. Osmose, Inc., Griffin GA., product "FirePro".

- c. Hoover Treated Wood Products, Inc., Thomson, GA product "PyroGuard".
- d. Viance, LLC., Charlotte, NC, product: "D-Blaze FRT".
- 2. Fire retardant treated wood shall comply with the following requirements:
  - a. All fire-retardant lumber and plywood must have an Underwriters Laboratories stamp signifying a FR-S rating certifying a 25 or less flame spread and smoke developed value, when tested in accordance to ASTM E-84, or UBC Standard No. 42-1.
  - b. Corrosion rates: Less than one mil per year for carbon steel, galvanized steel, aluminum, copper and red brass in contact with the fire retardant treated wood when tested in accordance with Federal Specification MIL-L-19140E Paragraph 4.6.5.2.
  - c. The fire retardant treated wood must have an equilibrium moisture content of not more than 25 percent when tested in accordance with ASTM D 3201 procedures at 95 percent relative humidity and 80 degrees Fahrenheit.
  - d. Fire retardant chemical: Registered for use as a wood preservative by the U.S. Environmental Protection Agency.
  - e. Testing: Fire performance and strength properties for both lumber and plywood, of the fire retardant treated wood shall be recognized by issuance of a ICC Evaluation Service Report. Fire retardant chemical must not damage the middle lammella of the wood structure when exposed to 170 degrees Fahrenheit and 90 percent relative humidity for 23 days.
- C. Pressure preservative treated wood. Designated as "PT"
  - 1. Chemical Manufacturer: Subject to compliance with the requirements specified herein, Products which may be incorporated in the work include:
    - a. Osmose, Inc., Griffin GA., product "NatureWood".
    - b. Universal Forest Products, Inc., Grand Rapids MI., product "ProWood ACQ".
    - c. Viance, LLC., Charlotte, NC., product "Preserve"
  - 2. Treatment: Ammoniacal Copper Quaternary Compound (ACQ), arsenic-free and chromium-free chemical "ACQ Preservative" in accordance with AWPA Standards. Apply the preservative in a closed cylinder by pressure process in accordance with AWPA Standard C15.
    - a. Minimum preservative retention for floor plates, framing, lumber and plywood above ground use: 0.25 pounds per cubic foot ( $4.0 \text{ kg/m}^3$ ) of ACQ chemical, in accordance with AWPA UC1, UC2, UC3A, and UC3B, or NER-643 as appropriate.
    - b. Minimum preservative retention for framing, lumber and plywood in contact with water, ground, concrete and masonry: 0.40 pounds per cubic foot ( $6.4 \text{ kg/m}^3$ ) of ACQ chemical, in accordance with AWPA UC4A, UC4B, UC4C, or NER-643 as appropriate.
    - c. Minimum preservative retention for lumber and plywood in permanent wood foundations: 0.60 pounds per cubic foot ( $9.6 \text{ kg/m}^3$ ) of ACQ chemical, in accordance with AWPA UC4B, or NER-643.

3. Fixation of Chemical: Treated wood shall not be shipped from treatment plant until fixation of the preservative has occurred in the wood.

## 2.3 ACCESSORIES

### A. Adhesives:

1. General: Provide adhesives approved which are Low-VOC or non-VOC, non-flammable, water-proof after cured, odor free.
2. Adhesive for lamination and fabrication of wood and plywood items: Exterior adhesives containing no urea formaldehydes.
3. Adhesive for subfloors and underlayment: High strength, waterproof and non-freezing adhesive complying with AFG-01 "Frozen Lumber Test" and ASTM 3498

### B. Nails (interior and exterior): Galvanized common nails, of size and type to suit application and as required by state and local building codes.

### C. Screws:

1. Screws for interior applications: Flat head electroplated-galvanized wood screws of the appropriate sizes.
2. Screws for exterior applications:
  - a. For ACQ pressure preservative treated wood: Flat head type 304 or 316 stainless steel only, wood screws, of the appropriate sizes. Aluminum, galvanized steel, and coated metal fasteners are prohibited.
  - b. For general application (non-pressure preservative treated wood): Flat head hard aluminum, or stainless steel, wood screws, of the appropriate sizes.

### D. Anchor bolts, expansion bolts and lag screws: Hot-dipped galvanized steel, of the following types:

1. For lumber having actual thickness of 1-1/2 inches or greater to masonry and concrete: Anchor bolts or expansion bolts, as most applicable for the specific receiving surface material, 3/8-inch minimum diameter, spaced as shown on drawings, and staggered as far as practicable. Countersink all bolt heads, and provide head washers of matching material.
2. For lumber having actual thickness of greater than 7/8-inch but less than 1-1/2 inches to masonry and concrete: Anchor bolts or expansion bolts, as most applicable for the specific receiving surface material, at least 1/4-inch diameter of the most appropriate lengths for the specific application, spaced as shown, and staggered as far as practicable. Countersink all bolt heads, and provide head washers of matching material.
3. For lumber having actual thickness of 7/8-inch and less: Anchor bolts or expansion bolts, at least 1/4-inch in diameter; or screws, of the most appropriate sizes; in lengths most suitable for the specific application, countersunk, spaced, and staggered.

### E. Protection paper: Canadian red-rosen paper or kraft paper.

### F. Building paper: ASTM D 226, Non-perforated, No. 15 (73 kg/sq m) asphalt-saturated building felt.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. All materials shall be inspected before use, with all checked, split and otherwise deficient stock rejected, or used only for miscellaneous blocking, furring or other incidental use. The Contractor shall be responsible for replacing all lumber which, due to warpage, twist, splitting, or checking, results in unsatisfactory work. Such replacement shall be required at any time, whether before or after application of finish material under other Sections.
- B. Verify exact locations of toilet accessories, door stops and similar items with Architect prior to installation of blocking for accessories.

#### 3.2 INSTALLATION - GENERAL

- A. Closely coordinate the installation of the rough carpentry work with the work of other trades responsible for the installation of interfacing or overlaying materials, so as not to delay the work of the related trades.
- B. Erect all rough carpentry work plumb, level, and true with tight, close fitting joints, securely attached and braced to surrounding construction, all in a first class workmanlike manner. Counterbore for bolt heads, nuts, and washers where required to avoid interference with other materials. Bear complete responsibility for structural integrity, connections, and anchorage of all rough carpentry work.
- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- D. Use as long lengths as practicable for wood nailers, blockings, and curbs, to minimize number of joints, and attach the members with the types, and spacing, of fasteners specified herein.
- E. Install blocking, grounds and furring, as required for proper attachment of the work of other trades, in accordance with the requirements provided by the respective related trades.
  - 1. Spacing for furring and strapping shall not exceed 16 inches on center.
- F. Field cuts of fire retardant treated lumber: Do not rip or mill fire retardant treated lumber. Only end cuts, drilling holes and joining cuts are permitted.
- G. Field cuts of ACQ pressure-treated lumber: Apply solution of copper naphthenate containing a minimum of 2 percent metallic copper in-solution, in accordance with AWWA standard M4. Brush liberally all cuts and holes.
- H. Install concealed from view plywood with specified fasteners spaced not more than 10 inches on centers.
- I. Install fire-treated plywood backer boards with counter-sunk galvanized fasteners, of specified sizes, spaced not more than 12 inches on centers.

### 3.3 INSTALLATION - WALL SHEATHING

- A. Install wall sheathing, in accordance with APA construction standards, using minimum number 8 screws, spaced 6 inches on centers around panel edges, and 12 inches on centers at intermediate supports.
- B. Secure sheathing with long dimension either parallel or perpendicular to wall studs with ends over firm bearing, stagger joints where possible.

### 3.4 INSTALLATION – EQUIPMENT BACKBOARDS

- A. Provide panel mounting backboards for HVAC, Fire Prevention, Electrical and telephone/data equipment. Fabricate panels using fire-retardant treated 3/4 inch thick panels mounted to fire-retardant treated 2 by 4's. Provide a nominal space of 3-1/2 inches behind panels to permit wiring.

### 3.5 CLEANING

- A. Daily clean work areas by sweeping and disposing of scraps and sawdust.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

### 3.6 SCHEDULES

- A. Wood treatment schedule:
  - 1. Pressure preservative treat all concealed or exposed-to-view:
    - a. Lumber and plywood which comes in contact with concrete, masonry, or earth.
    - b. Lumber and plywood nailers, blocking and curbing directly related to roofing, flashing, skylights, roof hatches, and roof accessories.
    - c. Lumber and plywood rough-bucks, blocking and nailers directly related to windows, curtainwall and storefront systems.
  - 2. Fire retardant treat all equipment backer boards, additionally provide fire retardant treated lumber and plywood where indicated or noted on Drawings.
- B. Wood blocking schedule: The following schedule lists common items for which blocking is required and may not be indicated on the Drawings. It is not the intention of this schedule to list all conditions requiring blocking or limit the extent of blocking required for completion of the Work; provide all wood blocking, edgings, nailers, required for receipt of various finishes and surfacing materials. Securely anchor wood blocking and run continuous between framing.
  - 1. Blocking sizes indicated below are minimum sizes for conditions which not otherwise sized or indicated on Drawings. In case of conflict, sizes identified on Drawings govern.

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Items	Nominal size of blocking with fastener notes
Corner guards;	2 by 4 inch
Door frames, cross corridors;	2 by 4 inch.
Door frame heads, of sliding, accordion, and bifolding doors;	2 by 4 inch
Door stops, wall mounted;	1 by 3 inch.
Grab bars;	3/4 inch plywood extending full height from floor to 3 inches above top mounting location. Install grab bars with 1/4 inch dia. Toggle bolts.
Lavatories;	3/4 inch plywood extending full height from floor to top of wall framing. Install lavatories with 1/4 inch dia. toggle bolts
Mirrors, framed;	2 by 4 inch
Soap dispensers, wall mounted;	1 by 3 inch
Paper towel dispensers, waste receptacles, feminine napkin dispensers;	1 by 3 inch.
Toilet paper dispensers;	2 by 4 inch
Towel bars;	2 by 6 inch, 1/4 inch diameter toggle bolts
Wall mounted railings;	2 by 6 inch
Window treatment (shades, blinds and curtains):	2 by 4 inch
Audio/Visual Wall Monitors and Touch Panels:	3/4 inch plywood extending full height from floor to top of wall framing. Coordinate locations with Interior Elevation Drawings. Install brackets with 1/4 inch dia. toggle bolts
Products bracketed to walls:	3/4 inch plywood extending full height from floor to top of wall framing. Install brackets with 1/4 inch dia. toggle bolts

End of Section



Section 06 20 00  
FINISH CARPENTRY

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
  - 1. Interior finish wood trim.
  - 2. Interior finish wood base.
  - 3. Storage and closet shelving, coat rods and related hardware.
- B. Install salvaged mailboxes at South Entry Lounge.
- C. Backprime all wood which comes in contact with cementitious and masonry materials

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, framing, curbs, nailers, and backer boards.
- D. Section 06 40 00 - ARCHITECTURAL WOODWORK:
  - 1. Quality Standards for woodwork.
  - 2. Furnishing and installing cabinetry, plastic laminated shelving, and other built-in-place furniture.
  - 3. Plastic laminated countertops.
- E. Section 06 48 46 – INTERIOR FIRE RATED WOOD DOOR FRAMES.
- F. Section 07 92 00 - JOINT SEALANTS: Sealant and backing materials, for joints between casework, countertops and abutting surfaces.
- G. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing hollow metal doors.

- H. Section 08 14 16 - FLUSH WOOD DOORS: Furnishing wood doors.
- I. Section 08 14 33 - STILE AND RAIL WOOD DOORS: Furnishing wood doors.
- J. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work, and attachment.
- K. Section 09 29 00 - GYPSUM BOARD: Drywall construction work having taped and compounded finish.
- L. Section 09 91 00 - PAINTING: Field applied primer (excluding back priming) and finish coatings.

#### 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.
  - 1. ANSI A250.11 (formerly SDI 105) - Recommended Erection Instructions for Steel Doors and Frames.
  - 2. APA - applicable grades and specifications.
  - 3. ASTM D-6662 – Polyolefin-Based Plastic Lumber Decking Boards.
  - 4. FS MM-L-736 - Lumber; Hardwood
  - 5. FSC (Forest Stewardship Council): "FSC Certification Program"
  - 6. PS-1 - Construction and Industrial Plywood.
  - 7. PS-20 - American Softwood Lumber Standard.
  - 8. SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
  - 9. SPIB Grading Rules, current edition.
  - 10. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber
  - 11. American Lumber Standards Committee, National Lumber Grades Authority for Canadian Lumber, and applicable grading rules and standards of the various lumber associations whose species are being used for grades specified.
  - 12. AWPA C-20 - Structural Lumber Fire Retardant Treatment by Pressure Processes.
  - 13. AWPA C-27 - Plywood, Fire Retardant Treatment by Pressure Processes.
  - 14. MIL L1914OE - Lumber and Plywood, Fire Retardant Treated.
  - 15. UL Building Materials Directory.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
  - 1. AWI/AWMAC/WI joint publication: *North America Architectural Woodwork Standards*, version 3.1, as amended by published errata, referenced herein as NAAWS.
- C. Definitions:
  - 1. AWI: American Woodwork Institute

2. AWMAC: Architectural Woodwork Manufacturers Association of Canada, Alberta, Canada
3. FSC: Forest Stewardship Council
4. WI: Woodwork Institute.
5. NAUF: No added Urea Formaldehyde.

## 1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, installation instructions for hardware, adhesives and accessories furnished hereunder.
  2. Certifications:
    - a. Chain-of-Custody: Written documentation providing evidence of compliance with Chain-of-Custody supply of wood products, and compliance with FSC.
      - 1) Demonstrate that products are FSC-certified by providing vendor invoices. Invoices will contain the vendor's chain of custody number and identify each chain of custody certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.
    - b. NAUF: Certify that all composite wood and agrifiber products used on this Project are NAUF.
      - 1) Written certification from Millworker, that only "no-added formaldehyde" (NAUF) manufactured composite panel products are to be incorporated into the Work, including all concealed components. NAUF composite panel products include, but are not limited to, particle board (PB), oriented strand board (OSB), and medium density fiberboard (MDF) and similar manufactured products.
  3. Shop drawings:
    - a. Large scale design details, minimum 1-1/2 inch to one foot scale, showing profiles, jointing and fastening methods; and complete installation details.
    - b. Provide full scale drawings of wood trim elements required to match existing, showing all profiles and dimensions.
    - c. Provide shop drawings bearing dimensions of actual measurements taken at the project.
  4. Samples: Provide samples as requested by Architect for selection of colors and finishes.
  5. LEED Submittal Requirements:
    - a. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
      - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
        - a) Itemized vendor invoices for FSC-certified products.

- 
- b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
  - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
  - b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
    - 1) Recycled Content:
      - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
      - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
    - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
      - a) Documentation should be in the form of one of the following:
      - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
      - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
      - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
      - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
      - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
    - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - c. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
    - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
      - a) The exposure scenario used to determine compliance.
      - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:
        - 0.5 mg/m<sup>3</sup> or less;
        - Between 0.5 and 5.0 mg/m<sup>3</sup>; or
        - 5.0 mg/m<sup>3</sup> or more
      - c) Laboratory accreditation under ISO/IEC 17025.

- d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
- 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
- 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (composite wood products):
  - 1) Provide manufacturers' product data confirming that the composite wood products in the building have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for composite wood products installed within the waterproofing membrane.

## 1.6 QUALIFICATIONS

- A. FSC (chain of custody) wood products are required to be installed by an installer having current FSC certification. Submit certification for verification.

## 1.7 QUALITY ASSURANCE

- A. Quality Standards: All materials, workmanship and finishes shall meet AWI/AWMAC/WI *Architectural Woodwork Standards*, 2<sup>nd</sup>. Edition, as amended by published errata, for the following Quality Grades:
  - 1. All work to receive transparent finishes: *Architectural Woodwork Standards*, Premium Grade.

2. All work to receive shop-applied opaque finishes: *Architectural Woodwork Standards*, Premium Grade.
  3. All work to receive field-applied painted (opaque) finishes: *Architectural Woodwork Standards*, Premium Grade.
- B. Wood Products Chain of Custody: All wood products furnished under this Specification Section shall be "FSC certified" according to the rules of the Forest Stewardship Council.
1. FSC Certification includes the following certification bodies of forests and forest products:
    - a. SCS Global Services.
    - b. SmartWood.
    - c. SGS Qualifor.
    - d. Soil Association.
- C. Discard lengths of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacture with respect to surfaces, sizes or patterns.
- 1.8 PRE-INSTALLATION CONFERENCE
- A. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 06 40 00 - ARCHITECTURAL WOODWORK.
- 1.9 DELIVERY STORAGE AND HANDLING
- A. Do not deliver interior finish carpentry materials to the project until all concrete, masonry, plaster, and other wet work has been completed and dry.
- B. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location maintaining 60 degrees Fahrenheit and a maximum relative humidity of 55 percent.

## **PART 2 – PRODUCTS**

### **2.1 WOOD MATERIALS – GENERAL REQUIREMENTS**

- A. General: Materials, as fabricated and installed, shall comply with specified quality grades of AWI/AWMAC/WI *Architectural Woodwork Standards*.
1. All board products shall be S4S, except as otherwise specified.
- B. Chain of Custody: All wood products furnished under this Specification Section shall be "FSC Certified" according to the rules of the Forest Stewardship Council (FSC) or "CSA-SFM Certified" according to the rules of Canadian Standards Association International (CSA) Forest Products Group Sustainable Forest Management (SFM) Program.
1. FSC Certification includes the following certification bodies of forests and forest products:
    - a. SCS Global Services.

- b. SmartWood.
  - c. SGS Qualifor.
  - d. Soil Association.
- C. Moisture content:
- 1. Wood for interior use shall have a moisture content between 5 and 10 percent, when delivered to the project.
  - 2. Wood for exterior use shall have a moisture content between 9 to 15 percent, when delivered to the project.

## 2.2 BOARD AND PANEL MATERIALS

- A. Interior trim to receive paint (opaque finish): Wood shall be clear without knots or surface defects, and conform to AWI/AWMAC/WI "Architectural Woodwork Standards," latest edition for specified quality grades, (as installed). Acceptable wood species are limited to the following:
- 1. Yellow Poplar (*Liriodendron tulipifera*), Plain Sawn, clear straight-grained, C-Select or better.
  - 2. Natural Birch" Yellow Birch (*Betula alleghaniensis*), Plain Sawn.
  - 3. Natural Maple (*Acer saccharum*), Plain Sawn.
- B. Wood Base: Types WB-1 and WB-2, in profiles indicated on Drawings. Both to receive paint (opaque finish of species named herein above).
- C. Interior trim scheduled to receive transparent finish: Furnished under Section 06 40 00 – ARCHITECTURAL WOODWORK
- D. Plywood and panel products:
- 1. Shelving to receive paint: 3/4 inch thick Birch veneer plywood (AA) with 3/8 inch hardwood edge banding at all edges.
  - 2. Engineered panels scheduled for opaque finish: Medium Density Fiberboard (MDF) of thickness indicated on the Drawings, conforming to ANSI A208.2, product class MD-EXT having a minimum density of 45 pounds per cubic foot (769 kg/m<sup>3</sup>).
    - a. Georgia Pacific product "Synergite".
    - b. Canfibre Group Ltd., Toronto, Ontario Canada, product: "AllGreen MR MDF".
    - c. Norbord Industries Inc., Deposit, NY, Product: "Norbord MR"
    - d. SierrePine, product "Medex NC"

## 2.3 CLOSET AND SHELVING HARDWARE

- A. Metal closet rods and brackets:
- 1. Closet pole: 0.087 inch (2.21 mm) wall thickness steel tubing, 1-1/16 inch diameter, of custom cut lengths required for full width of closet, chrome finish.
    - a. Provide intermediate supports for span lengths greater than 48 inches.
- B. Adjustable shelving, wall mounted aluminum standards and brackets at offices, conference rooms, and elsewhere indicated:

1. Manufacturer: Rakks/Rangine Corporation, Needham MA.
2. Standards (uprights): C-Style surface mounted wall standards.
3. Brackets: 2 inches high "Rakks Style" brackets.
4. Finish: Custom color powder coat as selected by the Architect.

#### 2.4 ACCESSORIES AND HARDWARE

- A. Glue for lamination and fabrication of wood, plywood and particle board items:  
Exterior Grade, phenolic resin glue.
- B. Nails:
  1. Nails for interior trim items: 6d and 8d coated or galvanized finish nails, except as otherwise specified herein.
- C. Screws: Flat-head wood screws of the appropriate sizes, galvanized finish for interior use and stainless steel for exterior use.
- D. Bolts, nuts, washers, blind fasteners, lags: Galvanized, of size and type to suite application as indicated in the drawings.
- E. Paint for back-priming:
  1. California: "Wipe-Out 100% Acrylic Latex Stain Block", N° 52500.
  2. Glidden: Wall and Woodwork Primer Sealer, N° 1020.
  3. Moore: "Alkyd Enamel Underbody", N°. 217.
  4. Pittsburgh: "Speedhide Alkyd Interior Quick-Drying Enamel Undercoater", 6-6 Series.
  5. Sherwin-Williams: "Wall and Wood VOC Primer", B49 WZ2 Series.

### **PART 3 - EXECUTION**

#### 3.1 EXAMINATION

- A. Verify adequacy of blocking, backing and support framing for all finish carpentry work.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

#### 3.2 PREPARATION

- A. Back prime with specified primer all exterior wood trim prior to installation.
- B. Prime all wood surfaces of items or assemblies to be in contact with cementitious and masonry materials, prior to installation.

#### 3.3 INSTALLATION – GENERAL CARPENTRY

- A. Install work in accordance with AWI/AWMAC/WI "*Architectural Woodwork Standards*" for specified quality grades, except that all standing and running trim joints shall be field mitered and fitted.



- B. Dress and sand woodwork until free from machine and tool marks, abrasions, raised grain, or other defects that will show through the finish on surfaces exposed to view. Wherever possible, carry out sanding on a shop belt sander, not in the field. Sandpaper field joints and leave in perfect condition for finishing.
- C. Make all joints tight, and form to conceal shrinkage. Glue all miters having a dimension of 4 inches or more from heel to point. Joints shall be glued tight and so formed as to conceal shrinkage. Cope trim at returns and miter at corners to produce tight-fitting joints with full surface contact throughout length of joint.
- D. Make a minimum of splices and joints in running trim, and where such splices and joints occur, fasten securely, with all exposed surfaces having smooth, continuous planes. Stagger joints in adjacent or relate members. Use scarf joints for end-to-end joints.
- E. Scribe and cut work to fit adjoining work closely. Refinish cut surfaces in prefinished items.
- F. All nails in interior finished work shall be blind nailed wherever possible. Nail trim with finish nails only, set using appropriate nail punch and fill with matching wood filler. Sand smooth wood filler. Do not fasten trim with screws or bolts unless otherwise directed, or is to be subsequently covered with smaller trim.
- G. Woodwork shall be properly framed, closely fitted and accurately set to the required lines and levels and shall be rigidly secured in place. Shim as required using concealed shims to achieve specified tolerances.
- H. Cover exposed edges of plywood shelving with 3/8 inch hardwood edging. Width of edging to match thickness of shelving.

#### 3.4 INSTALLATION - PREFABRICATED PRODUCTS INSTALLED UNDER THIS SECTION

- A. Do not commence installation of products until immediately adjacent surfaces have been completely installed and finished.
- B. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.
- C. Install products absolutely level and in true line, with units securely anchored to the surrounding construction.
- D. Remove all tape and other packing materials; thoroughly clean and polish all exterior and interior surfaces.
- E. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

End of Section

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Section 06 20 13  
EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Description of existing assemblies: Exterior finish carpentry items indicated to remain and to be either selectively restored or replaced, including replacement in other materials, are present at the exterior faces of the building, including areas above the roof, as indicated on the drawings and as further described below:
1. Finish carpentry items include wood trim at eaves, at hanging gutters and at gable rakes.
  2. Existing conditions to be addressed in the work include weathering, deterioration and disappearance of wood material.
- B. Scope of Work:
1. Field-verification of conditions and dimensions of existing exterior wood elements.
  2. Protection of existing exterior wood elements indicated to remain without repair or replacement.
  3. Selective demolition of wood elements as indicated.
  4. Removal and replacement of wood elements as follows:
    - a. Decorative wood trim at new and rebuilt dormers (opaque finish).
    - b. Wood dutchman repair at entry vestibule (clear finish).
    - c. Work indicated in this paragraph and not on drawings. Quantities or percentages indicated are part of the contract work and are not subject to unit pricing or allowances. The intent of this paragraph is to quantify contract work not easily represented on drawings or whose location cannot be known before commencement of the work.
      - 1) An additional two percent relative to the wood trim removal and replacement work indicated on drawings.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
1. Requirements related to hazardous building materials including but not limited to asbestos are indicated in Division 02 Section ASBESTOS ABATEMENT.
  2. Painting is indicated in Division 9 section EXTERIOR PAINTING.
  3. Unit Prices in Division 1 Section "Unit Prices"
  4. Framing, blocking and similar work is indicated in Division 6 Section "Rough Carpentry".
  5. Roofing and flashing work at repaired roof decks is indicated Division 7 Sections for roofing and flashing.

6. Priming, backpriming and painting of finish carpentry is indicated in Division 9 Section "Exterior Painting"

## 1.2 SUBMITTALS

- A. Match to Existing: Work of this Section shall match appearance, dimensions, materials or other characteristics of existing assemblies at the building as indicated on the contract documents. For verification of matching, examine each existing assembly indicated and submit the items listed below.
  1. For all finish carpentry assemblies listed below, submit the following:
    - a. Measured drawing of existing: Full scale and back.
    - b. Photograph of existing: Photograph shall clearly identify the location of the measured assembly.
  2. Assemblies:
    - a. Wood trim at dormers.
    - b. Decorative wood trim at vestibule.
    - c. Other wood trim as indicated on drawings.
- B. Submit the following under provisions of Section 01 33 00 - Submittal Procedures:
  1. LEED Submittal Requirements:
    - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
      - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
        - a) a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
        - b) b) EPD shall have at least Cradle to Gate scope,
      - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
    - b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
      - 3) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
        - a) a) Itemized vendor invoices for FSC-certified products.
        - b) b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
      - 4) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
      - 5) Recycled Content:
        - a) a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
        - b) b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.

- c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
  - 6) Recycled Content:
    - a) a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
    - b) b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
  - 7) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
    - a) a) Documentation should be in the form of one of the following:
      - b) b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
      - c) c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
      - d) d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
      - e) e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
      - f) f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
  - 8) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an HPD.
- C. Refer to Division 01 Section "Submittals" for general submittal requirements.
- D. Product Data: Manufacturer's published technical data for each product to be used in work of this Section including material description, chemical composition (ingredients and proportions), physical properties, recommendations for application and use, test reports and certificates verifying that product complies with specified requirements.
- E. Work Description: Detailed description for each type of wood door restoration work to be performed. Do not begin work on site until Architect has approved Work Description in writing. Submit new written descriptive information. Photocopies of Contract Documents, excerpts from Contract Documents, and/or duplication of text in Contract Documents will not be accepted for Work Description.
- F. Wood Species Identification: Laboratory report as required by "Identification of Existing Wood Species" Paragraph in "Quality Assurance" Article, above.
- G. Shop Drawings: Dimensioned, detailed, scale drawings of each wood door to be restored. Submit newly prepared drawings showing site-verified conditions and

materials. Photocopies of Contract Documents and/or electronic scans of Contract Documents will not be accepted for Shop Drawing submittals.

1. Wood Elements and Surfaces: Elevations of door surfaces (minimum scale of 1-1/2 inches equals 1 foot) showing location, extent, and type of each dutchman repair, each fill, and each example of other kinds of repairs.
2. Details
  - a. Repairs: Each repair to be made, minimum 3 inches equals 1 foot, showing size, type of repair, configuration, and jointing.
  - b. Replacement Members: Each replacement showing member, joints, and profiles. Joints and profiles shall be full-size.
  - c. Hardware: Details for installing new hardware elements, 3 inches equals 1 foot, minimum.
  - d. Weatherstripping: Each condition (full-size).

#### H. Samples

1. Wood for Dutchman Repairs: Each species and cut to match existing, 6 inches x 12 inches, finished one side.
2. Members for Replacement Elements and New Components: Each profile, width of member x 12-inch length, finished one side and one edge.
3. Wood Patching Materials: Each type of patching material and each color necessary to match existing conditions, 2-inch-square samples.
4. Fasteners: Each type to be used for work of this Section.
5. Weatherstripping: Each type to be used, 12-inch length.

### 1.3 MOCK-UPS

- A. General: Before beginning general wood door restoration, prepare mock-ups to provide standards for work of this Section. Do not proceed with wood door restoration until Architect has approved mock-ups.
  1. Locate mock-ups as directed by Architect.
  2. Notify Architect 48 hours prior to start of each mock-up.
  3. Architect will monitor mock-ups.
  4. Use crew that will execute the work and follow requirements of this Section.
  5. Repeat mock-ups as necessary to obtain Architect's approval.
  6. Protect approved mock-ups to ensure that they are without damage, deterioration, or alteration at time of Substantial Completion.
  7. Approved mock-ups in undamaged condition at time of Substantial Completion may be incorporated into the Work.
  8. Approved mock-ups will represent minimum standards for wood door restoration. Subsequent wood door restoration work that does not meet standards of approved mock-ups will be rejected.

- B. Prepare the Following Mock-Ups
  - 1. Replacement Wood Elements to Match Original: One installed element of each type in each species of wood.
  - 2. Dutchman Repairs: One dutchman repair in each species of wood to be repaired.
  - 3. Flat-Grain Plugs: One plug.
  - 4. Repairs Using Wood Filler: One repair.
  - 5. Filling Scratches Using Shellac Sticks: One scratch.
  - 6. Stripping Existing Coatings and Finishes and Providing New Transparent Finish: One area, 4 square feet, for each combination of wood species and wood finish.
  - 7. Finishing Replacement Wood Members: One area, 4 square feet or size of member, whichever is less, for each combination of wood species and wood finish indicated below.
    - a. Wood Members with transparent finish.
    - b. Wood Members with opaque finish.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

#### 1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturer's written instructions and warranty requirements and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

### PART 2 - PRODUCTS

#### 2.1 LEED REQUIREMENTS

- A. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
  - 1. Provide products with Third Party Environmental Product Declaration (EPD) whenever possible.
- B. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
  - 1. Wood products that are not reused, salvaged, or recycled must be certified to the standards of the Forest Stewardship Council.
  - 2. Provide Products manufactured and extracted within 100 miles of the project site whenever possible.
  - 3. Recycled Content

- a. Provide products with the maximum amount of recycled content possible or Recycled content XXXX shall be at least XXX%
  - b. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- C. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
- 1. Provide products with publicly available material inventories whenever available.

## 2.2 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by the American Lumber Standards' Committee Board of Review. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

## 2.3 WOOD

- A. General: Where new material is needed, wood shall be as specified herein and as required for Premium Grade work as defined by Architectural Woodwork Institute's Architectural Woodwork Standards and shall be kiln-dried to a moisture content of 6 to 10 percent at time of fabrication.
  - 1. Wood that is to be finished or painted shall be free from defects and blemishes on surfaces exposed to view that will be visible after top coat of finish or paint is applied.
  - 2. Reject materials that are defective and do not comply with specifications for quality and grade or are otherwise not in proper condition.
- B. Wood for Dutchmen Repairs and Replacement Members: Match species, cut, color, and grain pattern of wood in existing door and comply with AWI requirements for material in "Premium Grade" wood doors.

## 2.4 FASTENERS

- A. Fasteners for Fabrication of Wood Elements: Comply with requirements of AWI Architectural Woodwork Standards and with standard industry practices for type and size of fasteners.
  - 1. Use only stainless steel or nonferrous nails and screws for fabrication and installation of wood door elements.
- B. Fasteners for Installation of Hardware and Other Elements: Comply with standard industry practices for type and size.
  - 1. Use salvaged original fasteners in good condition and new fasteners matching existing fasteners where salvaged original fasteners are not available.



2.5 ADHESIVES AND FILLERS

- A. Adhesive for Dutchman Repair and Assembly of New Elements: Two-component epoxy resin glue designed to be slightly flexible when cured. Provide West System 105 Resin and 206 Slow Hardener as manufactured by West System, 102 Patterson Ave., Bay City, MI 48707 (866-937-8797), or approved equal.
- B. Stainable Paste Wood Filler: As selected by wood door restoration specialist and approved by Architect.

2.6 WOOD REPAIR MATERIALS

- A. Shellac Sticks: Shellac sticks to match color of surface to be filled.
- B. Retouching Crayons: Beeswax sticks impregnated with powdered dry pigments matching color of surface to be filled.
- C. Wax Filler Sticks: Hard wax sticks colored with natural pigments matching color of surface to be filled. Provide one of the following or approved equal.
- D. Patching Material and Filler for Woodwork with Transparent Finish: Pigmented, two-component epoxy putty specifically formulated and colored for patching wood. Provide Wood Epoxy Putty Sticks as manufactured by Mohawk Finishing Products, RPM Wood Finishes Group, Inc., P.O. Box 22000, Hickory, NC 28603 (800-545-0047), or approved equal, in color to match wood being patched in each case. Mix different colors of putty sticks as required to match wood being patched.
- E. Color Putty for Filling Splits, Nail Holes, and Similar Small Depressions: Color Fil Putty as manufactured by Mohawk Finishing Products, RPM Wood Finishes Group, Inc., P.O. Box 22000, Hickory, NC 28603 (800-545-0047), or approved equal, in color to match wood being patched in each case. Mix different colors of color putty as required to match wood being patched.

2.7 EXTERIOR STANDING AND RUNNING TRIM

- A. Lumber Trim for Painted Applications: Kiln-dried, solid lumber with surfaced (smooth) face and of the following species and grade: Grade D Select eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods; NELMA, NLGA, WCLIB, or WWPA.
- B. Lumber Trim for Clear-Finished Applications: Kiln-dried, solid lumber with surfaced (smooth) face and of the following species: White oak.

2.8 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide stainless steel nails or screws of the following materials, in sufficient length to penetrate minimum of 1-1/2 inches into substrate, unless otherwise recommended by manufacturer.

- B. Flashing: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim" for flashing materials installed in finish carpentry.
- C. Sealants: Comply with requirements in Division 7 Section "Joint Sealants" for materials required for sealing siding work.

## 2.9 FABRICATION

- A. Wood Moisture Content: Comply with requirements of specified inspection agencies and with manufacturer's written recommendations for moisture content of finish carpentry at relative humidity conditions existing during time of fabrication and in installation areas.
- B. Back out or kerf backs of the following members, except members with ends exposed in finished work:
  - 1. Exterior standing and running trim wider than 5 inches.
  - 2. Wood board paneling.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 WOOD ELEMENT RESTORATION – NUMBERED DRAWING NOTES

- A. General: Paragraphs below correspond to numbered keynotes on the drawings and to other quantities of work not shown on drawings but indicated in Part 1 of this Section. Detailed scope of work and execution requirements are indicated at each item.
- B. WD 1 - wood replacement
  - 1. Remove broken, rotted, or decayed wood down to sound wood.
  - 2. Match species of existing type of wood in-kind or use African mahogany, plain sawn, sustainably harvested or approved.
  - 3. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member. Fabricate replacement members according to AWI Section 1000 requirements for Premium Grade.
  - 4. Secure new wood using finger joints or multiple dowels with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding wood.

3.3 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Prepare lumber for exterior finish application indicated in the contract documents. Comply with requirements in Division 9 Section "Painting."

3.4 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
- B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
  - 1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  - 2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
  - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

3.5 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than **36 inches** long, except where indicated. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment. Fit exterior joints to exclude water. Apply flat grain lumber with bark side exposed to weather.

3.6 ADJUSTING

- A. Replace finish carpentry that is damaged or does not comply with requirements. Finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.7 CLEANING

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

End of Section

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Section 06 40 00  
ARCHITECTURAL WOODWORK

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Wood veneer casework.
  - 2. Plastic laminate casework.
  - 3. Millwork enclosures for fan coil units, including:
    - a. Brass grating for supply air discharge.
    - b. Painted metal grating for return air intake,
    - c. Perforated sheet metal panels at Cabinetry.
  - 4. Exposed blocking and blocking concealed by the work of this Section required for the installation of architectural woodwork.
  - 5. Hardware for work of this Section.
- B. Modify salvaged doors, clean doors, touch-up scratches and defects, and install as wall panels.
- C. Furnish the following products to be installed under the designated Sections:
  - 1. Doors salvaged under Section 02 41 19 – SELECTIVE DEMOLITION, modify and reinstall as wall panels.
  - 2. Mailboxes salvaged under Section 02 41 19 – SELECTIVE DEMOLITION, modify and reinstall in South Entry Lounge.
  - 3. Wood trim having shop-applied transparent finish, for installation by Section 06 20 00 - FINISH CARPENTRY.
- D. Make all cut-outs within casework items as required to accommodate sinks, piping, conduit, and other mechanical and electrical work, from templates provided by the respective mechanical and electrical trades.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.

- C. Section 02 41 19 – Selective Demolition: Removal and salvage of designated doors for re-use as wall paneling, modified and installed as part of the work of this Section 06 40 00.
- D. Section 05 50 00 - METAL FABRICATIONS: Supports for countertops.
- E. Section 05 70 13 - DECORATIVE METALS – BRASS / BRONZE: Requirements for bronze materials and finishing.
- F. Section 06 10 00 - ROUGH CARPENTRY: Concealed wood blocking and nailers.
- G. Section 06 20 00 - FINISH CARPENTRY:
  - 1. Fixed wood shelving and trim.
  - 2. Interior and exterior wood trim.
  - 3. Reinstallation of salvaged mailboxes.
- H. Section 06 48 46 –FIRE RATED WOOD DOOR FRAMES.
- I. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work.
- J. Section 09 29 00 - GYPSUM BOARD: Wall board construction work, having taped and compounded joint finish.
- K. Section 11 31 00 - RESIDENTIAL APPLIANCES.
- L. Division 22 - PLUMBING: Plumbing fixtures and piping.
- M. Division 26 - ELECTRICAL: Electrical connections for lighting.

#### 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - References. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. AAMA 2603 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum (as amended).
  - 2. ASTM D 523 - Standard Specification for Specular Gloss.
  - 3. FSC (Forest Stewardship Council): "FSC Certification Program"
  - 4. ANSI/HPVA HP-1 – American National Standard for Hardwood and Decorative Plywood.
  - 5. ANSI / AHA A135.4 – Basic Hardboard Standard.
  - 6. APA Grades and Specifications.
  - 7. National Lumber Grades Authority, American Lumber Standards, and Grading Rules and Standards of the various lumber associations whose species are being used, with grade-marks for same.
  - 8. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber; and Product Standard (PS):

- a. PS-1 - Construction and Industrial Plywood Standard. (on 3/2018 this is still current)
  - b. PS-20 - American Softwood Lumber Standard.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. AWI/AWMAC/WI joint publication: *North America Architectural Woodwork Standards*, version 3.1, as amended by published errata, referenced herein as NAAWS.
- C. Definitions:
1. AWI: American Woodwork Institute.
  2. AWMAC: Architectural Woodwork Manufacturers Association of Canada, Alberta, Canada.
  3. FSC: Forest Stewardship Council.
  4. HPVA: Hardwood Plywood & Veneer Association.
  5. WI: Woodwork Institute.
  6. NAUF: No added Urea Formaldehyde.

## 1.5 ADMINISTRATIVE REQUIREMENTS

- A. At least two weeks before scheduled delivery of woodwork, conduct a pre-installation conference at the Project site. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
1. Required attendees: Architect, Contractor, installers of woodwork, woodwork fabricator representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
    - a. Section 02 41 19 – Selective Demolition.
    - b. Section 05 70 13 - DECORATIVE METALS – BRASS / BRONZE.
    - c. Section 06 20 00 - FINISH CARPENTRY
    - d. Section 08 71 00 - DOOR HARDWARE.
    - e. Section 09 26 13 - GYPSUM VENEER PLASTERING.
    - f. Section 09 29 00 - GYPSUM BOARD.
    - g. Section 09 30 13 - CERAMIC TILING.
    - h. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES.
    - i. Section 09 65 16 - RESILIENT SHEET FLOORING.
    - j. Section 09 65 19 - RESILIENT TILE FLOORING.
    - k. Section 09 65 23 - RUBBER FLOORING.
    - l. Section 09 68 00 - CARPETING.
    - m. Section 09 91 00 - PAINTING.
    - n. Section 14 24 00 - HYDRAULIC ELEVATORS.
    - o. Section 22 00 00 - PLUMBING.
    - p. Section 23 00 00 - HEATING, VENTILATING, AND AIR CONDITIONING.

- q. Section 26 00 00 - ELECTRICAL.
  - 2. Agenda:
    - a. Scheduling of woodwork operations.
    - b. Review of salvaged materials which are designated for reincorporation into project.
    - c. Review of staging, material storage locations and temporary protection of stored items.
    - d. Ambient conditioning and environmental controls.
    - e. Coordination of related work.
    - f. Protection of installed woodwork.
  - 3. Delivery and installation of woodwork may only proceed when everyone concerned agrees that required ambient conditions can be maintained.
- B. Sequencing:
- 1. Field Measurements: Where possible the woodwork manufacturer shall take field measurements before preparation of shop drawings and fabrication to ensure proper fitting of Work.
    - a. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
  - 2. Field dimensions which are not controlled by Project conditions: The woodwork manufacturer is responsible for details and dimensions not controlled by Project conditions and shall show on his shop drawings all required field measurements beyond his control.
    - a. The Contractor shall acknowledge the woodwork fabricator's need for accurate field dimensions prior to custom fabrication.
    - b. The Contractor and the woodwork manufacturer shall cooperate to establish and maintain these field dimensions.
- C. Scheduling:
- 1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
  - 2. Fabric facing materials and several of the hardware products require long lead time. To ensure smooth progress of the Project, the Contractor shall submit under the requirements of Section 01 33 00 - SUBMITTAL PROCEDURES affirmation of purchase orders for the fabric facing materials and all of the specified hardware.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following in compliance with *AWI/AWMAC/WI NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS (NAAWS)*, version 3.1, Section 1 – Submittals. and as specified under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
- 1. Product Data: Manufacturer's product data sheets, specifications, performance data, for each item furnished hereunder, including, but not limited to: Fastenings, adhesives, hardware, and accessories.



2. Shop drawings bearing dimensions of actual measurements taken at the project, include at least the following, which are in addition to shop drawing requirements described in NAAWS:
  - a. 1/4 inch scale elevations and plans of each casework item.
  - b. Large scale design details of minimum 1-1/2 inch to 1-foot scale, showing abutting materials, installation conditions, clearances. Show details of drawers and doors.
  - c. Full size or half-full size sections, showing individual components, profiles and jointing.
3. Selection Samples:
  - a. Plastic laminate chips for initial color selection by Architect.
  - b. Melamine chips for initial color selection by Architect.
  - c. Chain of PVC edging materials.
  - d. Provide additional samples as requested by Architect for initial selection of material colors and finishes.
4. Verification Samples:
  - a. 12 by 12 inch samples of wood veneer illustrating maximum range of color variations and applied transparent shop finish for each finish required, including samples matching existing where required,
  - b. 12 inch long samples of solid hardwoods illustrating maximum range of color variations and applied transparent shop finish for each finish required, including samples matching existing where required.
  - c. 12 by 12 inch samples of plastic laminate (of each color required for project).
  - d. 12 inch length samples of plastic edging material (of each color required for project).
  - e. 12 by 12 inch samples of Melamine board.
  - f. 12 by 12 inch size sample of Fan-Coil Unit (FCU) cabinet heat shield.
  - g. 24 by 24 inch samples of each type of wood paneling designated to match existing wood panels. (Several types of existing panels are required to be matched).
  - h. One full sized existing wood door salvaged for repurposing into panelling (sample to be maintained on site). Sample to include minor scratch and patch repairs, and cleaning. Approved sample may be included in specified mock-up paneling installation.
5. Certificates:
  - a. Chain-of-Custody: Written documentation providing evidence of compliance with Chain-of-Custody supply of wood products, and compliance with FSC.
    - 1) Demonstrate that products are FSC-certified by providing vendor invoices. Invoices will contain the vendor's chain of custody number and identify each chain of custody certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.

- b. NAUF: Certify that all composite wood and agrifiber products used on this Project are NAUF.
  - 1) Written certification from Millworker, that only “no-added formaldehyde” (NAUF) manufactured composite panel products are to be incorporated into the Work, including all concealed components. NAUF composite panel products include, but are not limited to, particle board (PB), oriented strand board (OSB), and medium density fiberboard (MDF) and similar manufactured products.
- 6. Manufacturer’s Instructions: Provide installation instructions and templates for hardware and field applied items.
- 7. Special Procedure Submittals:
  - a. Provide substantiated proof that purchase orders have been placed, for all of the specified hardware , fabric facing materials and leather facing materials. Deliver specified information within **30** calendar days of Notice to Proceed or Date of Agreement whichever is earlier.
- 8. LEED Submittal Requirements:
  - a. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
    - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
      - a) Itemized vendor invoices for FSC-certified products.
      - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
    - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
  - b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
    - 1) Recycled Content:
      - a) Provide manufacturers’ product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
      - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
    - 2) Provide manufacturers’ product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
      - a) Documentation should be in the form of one of the following:
      - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)

- c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
  - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
  - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
  - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
- 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- c. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.

- 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (composite wood products):
  - 1) Provide manufacturers' product data confirming that the composite wood products in the building have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for composite wood products installed within the waterproofing membrane.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
  1. Sustainable Design Closeout Documentation:

#### 1.7 QUALITY ASSURANCE

- A. Quality Standards: All materials, workmanship and finishes shall meet *AWI/AWMAC/WI NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS (NAAWS)*, version 3.1, as amended by published errata, for the following Quality Grades:
  1. All work to receive transparent finishes: Premium Grade.
  2. All plastic laminated work: Custom grade.
- B. Qualifications:
  1. Fabricator/Installer: AWI member specializing in architectural woodwork of type specified herein having a minimum of 5 years documented experience.

#### 1.8 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Provide field mock-ups of salvaged doors being repurposed for wall panelling. Provide mock-up of minor touch-ups, and cleaning of existing doors to demonstrate standards for work of this Section. Provide equivalent of 2 doors installed as wood panels.
- C. Accepted mock-up panel having approved method of cleaning procedures will become the standard for Work of this Section.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  1. General: The woodwork manufacturer, woodwork installer and the Contractor are jointly responsible to make certain that woodwork is not delivered until the building and storage areas are sufficiently dry so that the woodwork will not be damaged by excessive changes in ambient humidity and relative moisture content.

2. Concrete, masonry, plaster, tile and marble setting and polishing and other wet work shall be completed and dry before delivery, storage and installation of woodwork items.
  3. Sequence deliveries to avoid delays and to minimize on-site storage.
- B. Storage and Handling Requirements:
1. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.

#### 1.10 SITE CONDITIONS

- A. Temperature: Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, and during installation of architectural woodwork; maintain temperature after installation until Owner's Final Acceptance.
- B. Relative Humidity: Maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before, and during, installation of architectural woodwork: maintain relative humidity after installation until Owner's Final Acceptance.

### PART 2 - PRODUCTS

#### 2.1 WOOD MATERIALS – GENERAL REQUIREMENTS

- A. General requirements:
1. Solid wood components: New, dressed four sides (S4S), and free from warping and other defects.
  2. Panel Products: Composite panel products and plywood shall be “no added urea-formaldehyde”, including all concealed components.
    - a. Composite panel products include but are not limited to particle board (PB), Medium Density Fiberboard (MDF), wheatboard and strawboard and similar manufactured products.
  3. Moisture Content:
    - a. Solid hardwood(s) scheduled for transparent finish: Moisture content shall not exceed 8 percent when delivered to Project.
    - b. Typical (hardwood and softwoods): Moisture content of wood shall be between 5 and 10 percent when delivered to the project.
  4. Chain of Custody: All wood products furnished under this Specification Section shall be “FSC Certified” according to the rules of the Forest Stewardship Council (FSC) or “CSA-SFM Certified” according to the rules of Canadian Standards Association International (CSA) Forest Products Group Sustainable Forest Management (SFM) Program.
    - a. FSC Certification includes the following certification bodies of forests and forest products:
      - 1) SCS Global Services.
      - 2) SmartWood.
      - 3) SGS Qualifor.
      - 4) Soil Association.

- B. Wood Species:
1. Exposed wood scheduled for transparent finish, meeting NAAWS Premium Grade Standards (as installed).
    - a. WD-1: American Black Cherry (*Prunus serotina*), Plain Sliced
    - b. Wood shall color match specified veneer, and be clear without knots, and other natural defects.
  2. Medium Density Fiberboard (MDF) Moisture Resistant Panels: No-Added-Urea-Formaldehyde (NAUF), of thickness indicated on the Drawings, conforming to ANSI A208.2, Grade 155, product class MR50, fabricated from 100 percent recycled fiber, using formaldehyde free synthetic resin such as methyl diisocyanate (MDI), having a minimum density of 45 pounds per cubic foot (769 kg/m<sup>3</sup>).
    - a. SCS or equivalent certified for recycled fiber content.
    - b. Acceptable products include the following or approved equal.
      - 1) Arauco (Flakeboard Brand) Bennettsville, SC, product "Vestex MR50"
      - 2) Georgia Pacific, product: "UltraStock MR+Free".
      - 3) Roseburg South Dillard, OR., product "Medex"
- C. Hardboard: Double tempered type, 1/4 inch thick, in compliance with ANSI / AHA A135.4 – Basic Hardboard Standard.
- D. Concealed supports for edge and corner backing shall be kiln dried birch or poplar, meeting AWI Premium Grade Standards.
- E. Blocking and furring at base and walls shall comply with American Softwood Lumber Standard PS 20-70 and with specific grading requirements of SPIB: Kiln dried (KD15), Structural Light Framing, N<sup>o</sup>. 2 grade, free of warping and large knots.
- F. Internal concealed framing for casework: Kiln-dried, (KD15), eastern pine, poplar, eastern spruce, or southern pine, conforming to AWI Premium grade.
- G. Fir plywood for concealed from view applications in conjunction with the various casework items: APA C-C PLUGGED EXT.

## 2.2 WOOD VENEERS

- A. Veneered panels for transparent finish: The face veneer for transparent finishes shall be minimum 1/28 inch thick on doors, shelves, panels and other exposed surfaces meeting AWI Premium Grade Standards (installed). Each exposed face shall be of tight smooth veneer with joints parallel to vertical edges with no sharp contrasts.
1. Wood Species: American Black Cherry (*Prunus serotina*), Plain Sliced, Grade AA.
  2. Matching of adjacent pieces of veneer: book matched.
  3. Panel face assembly: Balanced.
  4. Direction of Grain: Vertical
  5. Matching of Adjacent Panels: Sequence matched uniform size sets.

6. Matching Pre-manufactured Panels: (Specify one of the following: Pre-manufactured sets, full width; Pre-manufactured sets, reduced; Sequence matched uniform size sets; or Blueprint matched panels and components {Doors, Furniture, Fixtures})

### 2.3 PLASTIC LAMINATE FACING

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  1. Formica Corp., Cincinnati, OH.
  2. Laminart, Elk Grove Village, IL.
  3. Pioneer Plastics Corp. (Pionite), Auburn ME.
  4. Nevamar Corp., Odenton MD.
  5. Ralph Wilson Plastics Co. (Wilsonart), Temple TX.
- B. Plastic laminate, general purpose, conforming to NEMA LD3.1 -2005 Grade GP50, nominal 0.050 inch thickness, in a low non-directional texture in color price group selected by the Architect.
  1. General purpose grade laminate shall be used for all exposed to view surfaces including
    - a. Exposed outward face of cabinet fronts and closure trim.
    - b. Cabinet doors (all sides).
    - c. Drawer fronts (all sides).
    - d. Interior surfaces of open cabinets (without doors).
    - e. Plastic laminated trim.
  2. General purpose grade laminate shall be used for counter tops except where colored core laminate is indicated.
- C. Plastic laminate, unfinished balancing (backer) sheet, conforming to NEMA LD3-1985 undecorated laminate, Grade BK20, 0.020 inch nominal thickness.

### 2.4 POLYESTER LAMINATE (MELAMINE)

- A. Polyester laminate (melamine): Thermosetting acid resistant polyester resin impregnated laminate, permanently bonded to substrate.
  1. Polyester laminate to be 9 to 11 mils in thickness, 62% resin content, colorfast.
  2. The following requirements, standards and tests shall apply:
    - a. U.S. Federal: F.S.L. P-508
    - b. ASTM: D-1300-53T
    - c. U.S. Food & Drug: Section 175.300
    - d. NEMA: LQ1-1977
    - e. NEMA: LD3-1980
- B. Provide colored polyester laminate for where indicated on Drawings. Color shall be white, black, buff or grey as selected by Architect.

1. Polyester laminate shall be used for the interior surfaces of all 'closed cabinets,' where general purpose grade laminate is not required.
  2. All cabinet shelving shall be polyester laminate.
- C. Melamine panel backing: At fabricator's option, one of the following:
1. Mattformed three layer medium density wood particle panel (PB), graded M2 per ANSI A 208.1 with a minimum density of 48 pounds per cubic foot.
  2. Moisture resistant medium density fiberboard (MDF) conforming to ANSI A208.2 product class MD, having a minimum density of 44 pounds per cubic foot.

## 2.5 BACKING FOR LAMINATES AND VENEERS

- A. Cabinetry case body, and countertops without sinks: Mattformed three layer medium density wood particle panel (PB), graded M2 per ANSI A 208.1 with a minimum density of 48 pounds per cubic foot or equivalent hardwood plugged plywood complying with ANSI/HPVA HP-1.
1. "No Formaldehyde Added": Provide board which is fabricated using pre-consumer recycled wood fibers and an exterior-grade urea-formaldehyde free resin binder. Product shall contain no formaldehyde additives. Acceptable products include the following or approved equal.
    - a. Collins Pine Company (distributed through Panel Source International, Tacoma WA.), product: "PureKor Particleboard Plus"
    - b. Plummer Forest Products, Post Falls ID., product "PFP particleboard".
    - c. SierrePine Inc., Martel, CA., product "Encore SDP"
  2. Thicknesses:
    - a. 3/4 inch thick at cases.
    - b. 1 inch thick at shelves under 30 inches wide.
    - c. 1 1/8 inch thick at shelves 30 inches or more wide.
    - d. 1 1/8 inch thick at counters without sinks.
- B. Drawers and doors: Medium density fiberboard (MDF) conforming to ANSI A208.2 product class MD, fabricated from 100 percent pre-consumer recycled fiber, using formaldehyde free polyurethane/synthetic resin such as methyl diisocyanate (MDI) or (pMDI), having a minimum density of 45 pounds per cubic foot.
1. Acceptable products include the following or approved equal:
    - a. Canfibre Group Ltd., Toronto, Ontario Canada, product: "AllGreen MDF".
    - b. Collins Pine Company (distributed through Panel Source International, Tacoma WA.), product: "PureKor MDF Plus"
    - c. SierrePine Inc., Martel, CA., product "Medite II"
    - d. Temple Inland, Austin TX., product "UltraStock – Free."
  2. Thicknesses:
    - a. Typical: 3/4 inch thick panels, except as otherwise indicated or specified.
    - b. Doors over 36 inches tall: provide 1-1/4 inch thick panels.



## 2.6 PERFORATED SHEET MATERIAL

- A. Acceptable Manufacturers include the following or approved equal:
1. Accurate Perforating Company, Chicago IL.
  2. Diamond Manufacturing Company, Wyoming PA.
  3. McNichols Company., Tampa, FL
  4. Erdle Perforating Company Inc., Rochester, NY
- B. Characteristics:
1. Material: Bronze/Muntz Metal, 0.050 thickness.
  2. Perforation size: 0.50 (8/16) inch.
  3. Perforation shape: Square.
  4. Arrangement of perforations: Straight line.
  5. Spacing of perforations: 0.687 centers.
  6. Open area: 53.00 percent.
  7. Margins:
    - a. Side margins: 0.25 inches.
    - b. End margins: Finished end pattern.
  8. Finish: Bronze anodized to match Architects Control Sample.

## 2.7 FAN COIL UNIT CABINET RADIANT HEAT BARRIER

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Heatshield Products, Escondido, CA., Product: "Oven Heat Shield", or approved equal.
1. Heat shield, resistant of up to 1100 degrees F., continuous temperature.

## 2.8 CABINET HARDWARE

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following:
1. Accuride Corp., Santa Fe Springs, CA.
  2. CompX International, Inc., Dallas TX.
  3. Doug Mockett & Company, Inc., Manhattan Beach, CA.
  4. Engineered Products Company, Flint MI.
  5. Glynn-Johnson, Indianapolis IN.
  6. Grass America Inc., Kernersville NC.
  7. H.B. Ives Company, Wallingford CT.
  8. Häfele America Company, Archdale NC.
  9. Julius Blum, Inc. , Stanley NC.
  10. Knape & Vogt, Grand Rapids, MI.
  11. (Lamp) Sugatsune America, Inc. Carson, CA..
  12. Mepla Inc., High Point NC.

13. Outwater Plastic Industries Inc., Woodridge NY.
  14. Stanley Hardware, New Britain CT.
  15. Waterloo Furniture Components, Ontario Canada.
- B. Door and drawer pulls: Provide manufacturer(s) and model(s) indicated on Drawings.
- C. Locks:
1. General:
    - a. Provide at least three keys per keyed alike group.
    - b. Finish: lock plug finish "nickel".
  2. Locks for drawers and doors: deadbolt type.
  3. Locks for front mounted gang locks.
- D. Catches: Magnetic.
- E. Casework hinges: five knuckle institutional, offset type for all swinging doors. Hinges shall be 2-1/2" long. Hinges are mounted with flathead screws, so applied to cabinets to withstand a weight load of 150 pounds minimum. Hinge finish: satin stainless steel.
1. Number of hinges:
    - a. Doors 48 inches and less in height: 2 hinges.
    - b. Doors over 48 inches in height: 3 hinges.
- F. Casework (European, concealed type) hinges:
1. General; number of hinges: Provide number of hinges recommended by manufacturer for size and weight of door, but not less than the following:
    - a. Doors up to 36 inches height, or weight not to exceed 11 pounds: 2 hinges.
    - b. Doors up to 60 inches height, or weight not to exceed 20 pounds: 3 hinges.
    - c. Doors up to 72 inches height, or weight not to exceed 33 pounds: 4 hinges.
    - d. Doors up to 90 inches height, or weight not to exceed 48 pounds: 5 hinges.
  2. Hinge for full overlay cabinet doors: Self closing concealed hinge having maximum 110 degree angle of opening, 3 way adjustment. Hinges shall be equal to Blum "Soft-Close BLUMotion Clip-Top Overlay Hinge" with straight arm, model N<sup>o</sup>. 71B3550.
    - a. Maximum door thickness 1 inch (26 mm).
- G. Pad silencers for doors: 10 mm (3/8 inch) diameter, self-adhesive resilient plastic or nylon buttons, at least 2 per door, in clear color.
- H. Drawer Slides (provide one pair per drawer except as noted otherwise):
1. For heavy loads including credenzas, file cabinets, store fixtures, linen closets and tool drawers: Full extension type, 150 pounds per pair minimum rated

capacity (for drawers over 30 inches, provide 175 pounds rated capacity), steel ball bearing rollers, drawer hold in feature.

- a. Acceptable slides, include the following, or approved equal:
    - 1) For drawers up to 24 inches wide:
      - a) Accuride N°. 4032.
    - 2) For drawers over 24 inches and up to 30 inches wide:
      - a) Accuride N°. 4032.
    - 3) For drawers over 30 inches wide:
      - a) Accuride N°. 4437.
  - b. Finish: clear lacquered zinc.
2. For desk and casework drawers (excluding file drawers): Full extension type, 100 pounds per pair minimum rated capacity, steel ball bearing rollers, lever disconnect, drawer hold in detent feature.
    - a. Acceptable slides are limited to: Accuride N°. 3832A.
    - b. Finish: clear lacquered zinc.
- I. Shelf supports.
    1. Shelf pins for laminated and wood shelving: plug-in type for 5mm diameter hole, Häfele model number 282.11.710 cast zinc alloy with nickel plated finish and recessed seat.
- J. Wire management grommets and covers: 2 inch diameter, as manufactured by Doug Mockett & Company, Manhattan Beach CA., model number "MM3 with 3A cover" or approved equal.
    1. Grommet Finish: Provide in metallic finish selected by Architect from Manufacturer's standard finishes.
    2. Locations: Provide where shown on Drawings, and if not shown, allow the following numbers of grommets; exact locations to be determined in field.
      - a. For counters 6 feet or less provide 2 wire grommets and covers.
      - b. For counters over 6 feet, provide 1 wire grommet and cover for every 42 inches of counter, or fraction thereof.

## 2.9 ACCESSORIES

- A. Glue for lamination and fabrication of wood and plywood items: Exterior Grade, phenolic resin glue.
- B. Counter support brackets (concealed mounting, typical): Equal to Rakks Flush Mount Counter Supports by Rakks/Rangine Corp, Needham MA.
  1. Construction: Fabricated from horizontal aluminum T section and vertical aluminum L section. Vertical leg designed to attach to side of supporting stud and be concealed by gypsum board or other wall finish.
    - a. Model EH-1212FM for up to 18 inch deep counters.
    - b. Model EH-1818FM for up to 24 inch deep counters.
    - c. Model EH-1824FM for up to 30 inch deep counters.
  2. Factory applied finishes: Exposed aluminum surfaces shall be free of scratches and other serious blemishes and be factory finished with:

- a. Primer suitable for field painting.
  - C. Counter support brackets (surface mounted with rounded ends, for selected locations, refer to Drawings): Equal to Rakks Counter Supports by Rakks/Rangine Corp, Needham MA.
    - 1. Model EH-1818R for 24 inch counters.
    - 2. Model EH-1824R for 30 inch counters.
  - D. Fasteners:
    - 1. Concealed joint fasteners: Threaded steel.
    - 2. Bolts, nuts, washers, lags, pins, and screws: Of size and type to suit application chrome finish in exposed-to-view locations.
- 2.10 FABRICATION - GENERAL
- A. Coordinate the fabrication of casework with that of the various trades responsible for installing materials and items which will be inserted into, or applied to, the casework surfaces. Obtain and verify templates, dimensions, and instructions from the respective trades before making cut-outs, holes, slots, and other cutting in the casework.
  - B. Shop assemble custom casework for delivery to site. Deliver in assemblies as large as possible for entrance into the designated areas. Provide for concealed job connections of adjacent units.
  - C. Prepare woodwork in the shop for all necessary electrical installations.
  - D. Fabricate, install and finish all work so that both sides of countertops, panels, doors, shelves and other casework are of balanced construction, to prevent warping.
  - E. Cap exposed plywood, and particle board edges.
  - F. Fit corners and joints hairline, secure with concealed fasteners.
  - G. Finish all solid wood and plywood surfaces smooth, and free from all machine and tool marks that will show through facing materials.
  - H. Make all joints tight, and form to conceal shrinkage. Glue all miters having a dimension of 4 inches or more from heel to point.
  - I. Provide shop fabricated counters, shop mitered components, closure trims with ample allowance for field cutting and fitting. Provide additional trim as required for scribing and site cutting.
  - J. Finished work shall be free from visible adhesive and pencil marks.
- 2.11 FABRICATION - CASEWORK
- A. Fabricate casework in accordance with requirements of AWI/AWMAC/WI "*Architectural Woodwork Standards*," latest edition, in grades specified herein, under the Article entitled "QUALITY ASSURANCE," and the following additional requirements:

1. Cabinets shall be in flush overlay construction, with drawer fronts and hinged doors overlapping openings a minimum of 1/4 inch all four sides.
  2. Fabricate cabinets in integral units, each completely enclosed, without the use of common partitions.
  3. Fabricate plastic laminated casework with top and bottom fillers and corner panels described as optional for Custom Grade Work in the Quality Standards.
  4. Drawers:
    - a. Laminated drawer fronts: High density laminate over 3/4 inch specified core material. Drawer fronts shall be applied to separate drawer body component sub-front.
    - b. Drawer bottoms (plastic laminated casework): 1/4 inch thick color polyester laminate, housed and glued into front, sides and back.
    - c. Underside of drawer to receive continuous hot melt glue at joint between bottom and back/sides/front for sealing and rigidity.
    - d. Reinforce drawer bottoms as required with intermediate spreaders.
  5. Doors: Square edge design, 3/4 inch thick, without any profiling and shall fully overlap the cabinet frame.
    - a. Laminate doors: Fabricate doors with particle board core and front and rear faces high-pressure laminate, of selected color.
    - b. Maintain a maximum 1/8" reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
  6. Base cabinets: Provide full horizontal top frame with glued and doweled joints, 3/4 inch plywood end panels and bottom. Bottom shall be glued and doweled and let into routed end panels. Provide 4 inch high toe rail, securely screwed to the end panels and to the bottom panel by concealed glue blocks.
  7. Wall cabinets: Provide same finishes as base cabinets, with 3/4 inch thick top and bottom veneered plywood panels. Top and bottom panels shall be glued and doweled and let into routed end panels. Back of case shall be recessed and let into routed end panels and further secured with glue blocks.
  8. Door and drawer spreaders: Provide minimum 3/4 thick full width cabinet body spreaders immediately behind all door/drawer and multiple drawer horizontal joints to maintain exact body dimensions, and close off reveal. Front edge to be match face of adjacent cabinet doors/drawers.
- B. Fan Coil Unit (FCU) Cabinets: Provide a full lining of FCU cabinets with specified heat shield. Seal all seams and edges with manufacturer's recommended heat resistant tape. Heat shield to be installed with manufactured adhesive, and additionally screwed into place utilizing fender washers.

## 2.12 FABRICATION OF PLASTIC LAMINATE CLAD ITEMS

- A. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Except as otherwise specified hereunder, fabricate plastic laminate clad items in strict accordance with the details on the Drawings, the approved shop drawings, and workmanship standards set forth in AWI/AWMAC/WI "*Architectural Woodwork Standards*," latest edition, in grade(s) specified herein.

- C. Shop fabricate all plastic laminate clad items. Adhere plastic laminate to particle board backing sheets by cold-press-method. Use of contact cements are not permitted. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Apply laminate backing sheet to reverse side of all laminated, panels, shelving and tops.
- D. Fit corners and joints hairline. Make all joints and miters tight, secure with concealed fasteners.

## 2.13 SHOP APPLIED FINISHING

- A. Transparent exposed-to-view finish: AWI/AWMAC/WI "*Architectural Woodwork Standards*," Premium Grade Factory/Shop Finish System Number 2 Transparent, "Pre-catalyzed Lacquer" system having a gloss effect matching Architect's control sample.
  - 1. Basis of Design Finish: Sherwin Williams product "MagnaMax Hi-Solids Water White Pre-Catalyzed Clear Lacquer", or approved equal, as recommended by woodwork fabricator to match Architect's finished control samples. Finish system to include:
    - a. One washcoat, reduced vinyl sealer, as recommended by applicator for desired finish
    - b. Colorant, dye stain, wiping stain or spray-applied as required to match Architect's control sample.
    - c. One coat sealer: Vinyl sealer.
    - d. Sand sealer (minimum 240 grit).
    - e. First application topcoat, applied 3.0 to 6.0 mils wet.
    - f. Sand topcoat (minimum 280 to 320 grit).
    - g. Second application topcoat, applied 3.0 to 6.0 mils wet.
    - h. Sand topcoat (minimum 280 to 320 grit).
    - i. Final application topcoat, applied 3.0 to 6.0 mils wet.
  - 2. Total Dry Film Thickness not to exceed 5.0 mils.
- B. Transparent exposed-to-view finish: Provide finish systems required to match each of the existing wood paneling types.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Verify adequacy of blocking, backing and support framing for all finish carpentry work.
  - 2. Examine pre-fabricated woodwork before installation and verify all packing has been removed.
  - 3. Beginning of installation means acceptance of existing substrate and project conditions.

### 3.2 PREPARATION

- A. Before installing work under this section, woodwork shall be conditioned to average prevailing humidity conditions in areas of installation.
- B. Protect other Work against undue soilage and damage by the exercise of reasonable care and precautions. Clean, repair, or replace any work so damaged and soiled to the acceptance of the Architect.

### 3.3 INSTALLATION - GENERAL

- A. Install work in accordance with the latest AWI/AWMAC/WI joint publication: *Architectural Woodwork Standards* in grade specified herein, under the Article entitled "QUALITY ASSURANCE".
- B. Woodwork shall be installed plumb, level, true and straight without distortions.
  - 1. Use concealed shims as required
  - 2. Work shall be installed to a tolerance of 1/8 inch in 8 feet for plumb and levelness, including tops.
  - 3. There shall be no variations in flushness of adjoining surfaces.
- C. Tops and woodwork shall be scribed and trimmed to fit adjoining work.
  - 1. Where cuts occur, refinish surfaces and repair damaged finishes
- D. Secure woodwork to anchors or built-in blocking or blocking directly attached to substrates.
  - 1. Secure woodwork to grounds, furring, stripping and blocking as required with countersunk, concealed fasteners and blind nailing performing a complete installation.

### 3.4 INSTALLATION - CASEWORK AND COUNTERTOPS

- A. Install casework without distortion so that doors and drawers fit openings properly and are accurately and evenly aligned.
- B. Adjust casework hardware centering the doors and drawers in the openings, and provide unencumbered operation.
- C. Complete the installation of hardware and accessory items as indicated.
- D. Tops: Anchor tops securely to base units and to other support systems as required.

### 3.5 TOLERANCES

- A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.

### 3.6 ADJUSTING

- A. To whatever extent work was not completed at shop or prior to installation of woodwork, perform and complete the specified finishing of woodwork.

- B. Repair damaged and defective woodwork where possible eliminating defects functionally and visually.
  - 1. Where not possible to repair damaged or defective work, replace with matching new work.
  - 2. Adjust joinery for uniform appearance.
- C. Adjust doors and drawers for smooth and balanced movement, lubricate hardware for use.

### 3.7 CLEANING

- A. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for handling and disposition of all construction and demolition waste.
- B. Daily clean work areas by sweeping and disposing of scraps and sawdust.
- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area leave area in broom-clean condition.
- D. Remove protective material from pre-finished surfaces, immediately prior to Final Acceptance.
- E. Carefully clean exposed and semi-exposed wood surfaces, in strict accordance with fabricator's instructions. Touch-up shop-applied finishes to restore damaged or soiled areas, matching adjoining finish.
- F. Wash down plastic laminate with a solution of mild detergent in warm water, applied with soft clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- G. Clean and polish hardware, and bright metal trim components.

### 3.8 PROTECTION

- A. Protect installed woodwork and maintain specified conditions, in a manner acceptable to both fabricator and installer. Ensure that work of this Section will not be damaged or soiled, and is completely free of defects at the time of final acceptance of Project by the Architect.

End of Section



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Section 06 48 46  
FIRE-RATED WOOD DOOR FRAMES

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Fire Rated Wood door frames (interior and exterior), installed under requirements of Section 08 05 13- COMMON WORK RESULTS – INSTALLATION DOORS AND HARDWARE.
    - a. Refer to Drawings A8.16 and A8.17 for locations.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 10 00 - ROUGH CARPENTRY: Concealed wood blocking and nailers.
- D. Section 06 20 00 - FINISH CARPENTRY:
- E. Section 06 40 00 - ARCHITECTURAL WOODWORK:
  - 1. Quality Standards for woodwork.
  - 2. Furnishing and installing cabinetry, plastic laminated shelving, and other built-in-place furniture.
- F. Section 08 05 13 - COMMON WORK RESULTS – INSTALLATION DOORS AND HARDWARE.
- G. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES.
- H. Section 08 14 16 - FLUSH WOOD DOORS.
- I. Section 08 14 33 - STILE AND RAIL WOOD DOORS.
- J. Section 08 14 34 - CUSTOM FABRICATED STILE AND RAIL WOOD DOORS.
- K. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work.

L. Section 09 91 00 - PAINTING.

#### 1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
1. ANSI A250.11 (formerly SDI 105) - Recommended Erection Instructions for Steel Doors and Frames.
  2. APA - applicable grades and specifications.
  3. ASTM D-6662 – Polyolefin-Based Plastic Lumber Decking Boards.
  4. FS MM-L-736 - Lumber; Hardwood
  5. FSC (Forest Stewardship Council): "FSC Certification Program"
  6. PS-1 - Construction and Industrial Plywood.
  7. PS-20 - American Softwood Lumber Standard.
  8. SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
  9. SPIB Grading Rules, current edition.
  10. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber
  11. American Lumber Standards Committee, National Lumber Grades Authority for Canadian Lumber, and applicable grading rules and standards of the various lumber associations whose species are being used for grades specified.
  12. AWPA C-20 - Structural Lumber Fire Retardant Treatment by Pressure Processes.
  13. AWPA C-27 - Plywood, Fire Retardant Treatment by Pressure Processes.
  14. MIL L1914OE - Lumber and Plywood, Fire Retardant Treated.
  15. UL Building Materials Directory.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. AWI/AWMAC/WI joint publication: *North America Architectural Woodwork Standards*, version 3.1, as amended by published errata, referenced herein as NAAWS.
- C. Definitions:
1. AWI: American Woodwork Institute
  2. AWMAC: Architectural Woodwork Manufacturers Association of Canada, Alberta, Canada
  3. FSC: Forest Stewardship Council
  4. WI: Woodwork Institute.

5. NAUF: No added Urea Formaldehyde.

## 1.5 ADMINISTRATIVE REQUIREMENTS

### A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

### B. Sequencing:

1. Field Measurements
  - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
  - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

## 1.6 SUBMITTALS

### A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Fabricator's product data sheets, specifications, and performance data.
2. Certification:
  - a. General: Fabricator's written certification stating that door frames, meet or exceed the requirements specified under this Section; that specified shop finishing has been performed; and that all fire-resistive requirements for the indicated Labels have been met.
  - b. Provide signed certification by agent of door frame manufacturer stating that machining, glazing and finishing of door frames shall be performed by only by the manufacturer in its facilities.
3. Door schedule: All door frames specified under this Section, coordinated with the both door and hardware schedules contained in the Contract Drawings.
  - a. Indicate door frames to be factory finished and finish requirements.
  - b. Indicate fire protection ratings for fire rated openings.
4. Shop drawings: Elevations, and large scale sections and details of door frame construction, indicating profiles, core construction, joinery, edges, and cut-outs for hardware and glazing and glazing.
  - a. Indicate dimensions and locations of mortises and holes for hardware.
  - b. Indicate dimensions and locations of cutouts.
  - c. Indicate requirements for veneer matching.
5. Verification samples:
  - a. Corner section of a 60 minute fire-resistant rated frame, showing core construction and joinery.
  - b. For transparent finishes: submit two 12 inch length section of frame finished samples of each specie of veneer specified.

1. Sustainable Design Submittals:

c. XXX

- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
  - 1. Bonds and Warranty Documentation:
    - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

#### 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards, existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of fire-resistant rated wood door frames.
- C. Certifications:
  - 1. Chain of Custody wood products: All wood products furnished under this Specification Section shall be "FSC certified" according to the rules of the Forest Stewardship Council (FSC).
    - a. FSC Certification includes the following certification bodies of forests and forest products:
      - 1) SCS Global Services.
      - 2) SmartWood.
      - 3) SGS Qualifor.
      - 4) Soil Association.
- D. Obtain fire-resistant rated door frames specified in this Section from a single manufacturer

#### 1.8 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 43 39 – MOCK-UPS.
- B. Provide mock-up door frame installed with scheduled door, illustrating color and finish, and demonstrating the minimum standard for the Work.
- C. Locate mock-ups where directed and include all surfaces and materials scheduled to receive a field applied finish.
- D. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.
  - 1. Protect mock-up from dust, soiling and damage until Project Substantial Completion.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
- B. Storage and Handling Requirements:
    1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
    2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
  - C. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.
    1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.
    2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
  - D. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.
- 1.10 SITE CONDITIONS
- A. Environmental Limitations: Do not deliver or install door frames until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period
- 1.11 FIELD MEASUREMENTS
- A. Verify that field measurements are as indicated on shop drawings.
- 1.12 WARRANTY
- A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 - WARRANTIES.
  - B. Manufacturer Warranty: In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Technical Glass Products (TGP), Snoqualmie, WA., product "FireFrames Hardwood Series."
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  - 1. Technical Glass Products (TGP), Snoqualmie, WA., product "FireFrames Hardwood Series"
  - 2. Ferche Millwork, Rice., MN., product "Fire Rated Wood Jambs.
  - 3. Masonite Architectural, Marshfield WI., product "Maiman Wood Jambs."
  - 4. Navy Island Inc., West St. Paul, MN., product "FlamTech."
  - 5. VT Industries, Holstein, IA., product "Wood Jambs."

### 2.2 20-MINUTE FIRE-RESISTANT RATED DOOR FRAMES

- A. Type: 20-minute rated hardwood door frame with borrowed lite, and transoms where indicated on Drawings, and as scheduled.
  - 1. Pressure Testing Type: Positive.
- B. Provide frame structure, minimum 1-1/2-inch thick by 4 13/16-inch wide, complying with referenced construction requirements.
- C. Material: 1/8-inch thick resawn hardwood face (not veneered) with minimum 1/2-inch thick hardwood edges bonded to engineered core in accordance with ASTM D 5456.
- D. Wood Species and Cut: Match species indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated. Specific gravity 0.37 at 12% moisture content.
  - 1. Unit 1 Locations: Hardwood paint grade, having specific gravity 0.37 at 12% moisture content.
  - 2. Unit 2 locations: Red Oak (*Quercus rubra*), Plain Sawn.
- E. Listing: Underwriters Laboratories (UL)
- F. Gasketing at 20-Minute Positive Pressure Frame: Pemko #S88.
- G. Fire clips not needed.

### 2.3 45-MINUTE FIRE-RESISTANT RATED DOOR FRAMES

- A. Type: 45-minute rated hardwood door frame with borrowed lite, and transoms where indicated on Drawings, and as scheduled.
  - 1. Pressure Testing Type: Positive.

- B. Provide frame structure, minimum 1-1/2-inch thick by 5-5/16-inch wide, complying with referenced construction requirements.
- C. Material: 1/8" thick resawn hardwood face (not veneered) with minimum 1/4" thick hardwood edges bonded to engineered core in accordance with ASTM D 5456.
- D. Wood Species and Cut: Match species indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated.
  - 1. Unit 1 Locations: Hardwood paint grade, having specific gravity 0.42 at 12% moisture content.
  - 2. Unit 2 locations: Red Oak (*Quercus rubra*), Plain Sawn.
- E. Classified: Underwriters Laboratories (UL).
- F. Gasketing at 45-Minute Positive Pressure Frame: Pemko #S88.
- G. Fire clips not needed.

#### 2.4 60-MINUTE FIRE-RESISTANT RATED DOOR FRAMES

- A. Type: 60-minute rated hardwood door frame with borrowed lite, and transoms where indicated on Drawings, and as scheduled.
  - 1. Pressure Testing Type: Positive.
- B. Provide frame structure, minimum 1-1/2-inch thick by 5-5/16-inch wide, complying with referenced construction requirements.
- C. Material: 1/8" thick resawn hardwood face (not veneered) with minimum 1/4" thick hardwood edges bonded to engineered core in accordance with ASTM D 5456.
- D. Wood Species and Cut: Match species indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated..
  - 1. Unit 1 Locations: Hardwood paint grade, having specific gravity 0.42 at 12% moisture content.
  - 2. Unit 2 locations: Red Oak (*Quercus rubra*), Plain Sawn.
- E. Classified: Underwriters Laboratories (UL).
- F. Gasketing at 45-Minute Positive Pressure Frame: Pemko #S88.
- G. Fire clips not needed.

#### 2.5 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect. Fabricate door frames in accordance with specified manufacturer's requirements, and in compliance with WHI, or UL requirements as appropriate.

- B. Factory machine for hinges, locks and all hardware furnished under Section 08 71 00 - DOOR HARDWARE which requires routing and mortising. Any required dados for frame assembly will be performed by the manufacturer prior to finishing.
  - 1. Machining will be performed with final hardware schedules, shop drawings, hardware templates and other essential information required to insure proper fit of doors, frames relite components and hardware.
    - a. Do not machine for surface hardware
  - 2. Machining tolerances will be in accordance with ANSI/WDMA I.S. 1-A1 1997.
  - 3. Fire-rated frames will be machined under observation and in strict accordance with the requirements of the listing agency.

## 2.6 FINISHES

- A. Shop Finishing Methods: Match doors to be installed into frames.

## **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Beginning of installation means acceptance of existing substrate and project conditions.

### 3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.

### 3.3 INSTALLATION

- A. Install Fire Rated Wood door frames under the requirements of Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.

End of Section



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Section 06 61 16  
SOLID SURFACING FABRICATIONS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Solid surface (solid polymer) countertops and window stools (designated CNT-1 and CNT-2).
  - 2. Solid surface (solid polymer) panels at showers (designated SSW-1).
  - 3. Solid surface (solid polymer) shelves with brackets.
  - 4. Sealant, for joints between countertops, backsplashes and abutting surfaces.
- B. Make all cut-outs within solid surfacing items as required to accommodate sinks, and other plumbing fixtures, from templates provided by the respective trades.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking and nailers.
- D. Section 06 40 00 - ARCHITECTURAL WOODWORK: Cabinetry, shelving and other shop fabricated casework.
- E. Division 22 - PLUMBING: Plumbing fixtures and piping.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Conference: Fabricator and Installer of the Work of this Section is required to attend pre-installation conference specified under Section 06 40 00 - ARCHITECTURAL WOODWORK.

1.5 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to

establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ASTM D638 - Tensile Properties of Plastics.
2. ASTM D785 - Rockwell Hardness of Plastics and Electrical Insulating Materials.
3. ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
4. ASTM D5420 - Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
5. ASTM E84 - Surface Burning Characteristics of Building Materials
6. ASTM E228 - Linear Thermal Expansion of Solid Materials with a Push-Rod Dilatometer
7. ASTM G21 - Determining Resistance of Synthetic Polymeric Materials to Fungi
8. ASTM G22 - Determining Resistance of Plastics to Bacteria
9. ASTM G155 - Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

B. Definitions:

1. Solid Surface: Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment

## 1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data. Identify available colors, shades, and gloss.
2. Certifications:
  - a. Chain-of-Custody (wood backing materials): Written documentation providing evidence of compliance with Chain-of-Custody supply of wood products, and compliance with FSC.
    - 1) Demonstrate that products are FSC-certified by providing vendor invoices. Invoices will contain the vendor's chain of custody number and identify each chain of custody certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.
  - b. NAUF (wood backing materials): Certify that all composite wood and agrifiber products used on this Project are NAUF.
    - 1) Written certification from Millworker, that only "no-added formaldehyde" (NAUF) manufactured composite panel products are to be incorporated into the Work, including all concealed components. NAUF composite panel products include, but are not limited to, particle board (PB), oriented strand board (OSB), and

- medium density fiberboard (MDF) and similar manufactured products.
3. Shop drawings: Large scale design details of minimum 1-1/2 inch-to-1 foot scale, showing abutting materials, installation conditions, clearances. Show profiles, jointing and fastening methods.
    - a. Coordination: Submit coordination drawings indicating plumbing and miscellaneous steel work indicating locations of wall rated or non-rated, blocking requirements, locations and recessed wall items and similar items
  4. Selection samples:
    - a. Solid surfacing samples for initial color selection by Architect.
    - b. Sealant material: Manufacturer's standard strips of sealant, in all available colors, for selections by the Architect.
    - c. Provide additional samples as requested by Architect for initial selection of material colors and finishes.
  5. Verification samples:
    - a. 12 by 12 inch samples of solid surfacing materials.
  6. LEED Submittal Requirements:
    - a. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
      - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
        - a) Itemized vendor invoices for FSC-certified products.
        - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
      - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
    - b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
      - 1) Recycled Content:
        - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
        - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
      - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
        - a) Documentation should be in the form of one of the following:

- 
- b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
  - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
  - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
  - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
  - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
- 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- c. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area

- 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.
  - e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (composite wood products):
    - 1) Provide manufacturers' product data confirming that the composite wood products in the building have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
    - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for composite wood products installed within the waterproofing membrane.
  - B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
    1. Maintenance Data: Manufacturer's care and maintenance data, including repair and cleaning instructions.
  - C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
    1. Commercial care and maintenance kit; include with instructional video.
- 1.7 QUALITY ASSURANCE
- A. Fabricator and Installer; with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
    1. Fabricator and Installer for solid surfacing products shall be trained and certified by solid surfacing manufacturer.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Concrete, masonry, plaster, tile and marble setting and polishing and other wet work shall be completed and dry before delivery, storage and installation of fabricated solid surface items.
  - B. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.
  - C. Sequence deliveries to avoid delays and to minimize on-site storage.
- 1.9 ENVIRONMENTAL REQUIREMENTS
- A. Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, during, and after installation of solid surfacing fabrications; maintain temperature until Owner's Final Acceptance.

#### 1.10 FIELD MEASUREMENTS

- A. Field dimensions: The fabricator is responsible for details and dimensions not controlled by Project conditions and shall show on his shop drawings all required field measurements beyond his control.
  - 1. The Contractor shall acknowledge the fabricator's need for accurate field dimensions prior to custom fabrication.
  - 2. The Contractor and the fabricator shall cooperate to establish and maintain these field dimensions.

#### 1.11 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on E. I. du Pont de Nemours and Company, Inc., Wilmington DE product, "Corian".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  - 1. E. I. du Pont de Nemours and Company, Inc., Wilmington DE product, "Corian".
  - 2. Aristec Acrylics LLC (Avonite Surfaces), Florence, KY., product "Avonite".
  - 3. Formica Corporation, Cincinnati, OH, product: "Solid Surfacing."
  - 4. LG Hausys America, Inc., Adairsville, GA., product: "HI Macs."
  - 5. Lotte Chemical California, Inc., La Palma, CA., product: "Staron."
  - 6. Wilsonart International, Inc. Temple TX, product: "Solid Surfaces."

#### 2.2 PERFORMANCE

- A. Performance/Design Criteria:
  - 1. Tensile Strength (tested per ASTM D638): 6000 psi min.
  - 2. Tensile Modulus (tested per ASTM D638): 1.5 x 10<sup>6</sup> psi min.
  - 3. Tensile Elongation (tested per ASTM D638): 0.4% min.
  - 4. Flexural Strength (tested per ASTM D790): 10000 psi min.
  - 5. Flexural Modulus (tested per ASTM D790): 1.2 x 10<sup>6</sup> psi min.
  - 6. Hardness (tested per ASTM D785): >85-Rockwell "M" scale min.
  - 7. Thermal Expansion (tested per ASTM E228): 2.2 x 10<sup>-5</sup> in./in./degrees F.
  - 8. Fungi and Bacteria (tested per ASTM G21 & G22): Does not support microbial growth.
  - 9. Flammability (per ASTM E84, NFPA 255 & UL 723): Class A.

### 2.3 SOLID SURFACING MATERIALS

- A. Polymer solid surfacing material: Non-porous surfacing material homogeneously composed of natural minerals and high-performance polymer, fabricated sizes and profiles as shown on the Drawings, in colors and finishes as selected by Architect.
  - 1. Solid surfacing material shall be NSF (National Sanitation Foundation) listed under publication 51 - Plastic Materials and Components used in Food Equipment and bear the "component" mark.
  - 2. Colors and patterns shall be as selected by the Architect.
- B. Sheet thicknesses shall be as specified below, or as otherwise indicated on Drawings.
  - 1. Countertops: One piece monolithic design 12mm (nominal 1/2 inch) thick with solid plywood backing.
  - 2. Backsplashes: 12mm (nominal 1/2 inch) thick in locations and heights as shown on the Drawings.

### 2.4 ACCESSORIES

- A. Plywood backing for countertops: APA C-C PLUGGED EXT, fir plywood, sanded, thickness as indicated on Drawings.
- B. Adhesive for build-up of solid surfacing sheets: color matched two-component seam adhesive as provided by solid surfacing manufacturer.
- C. Adhesive for installation of trim components, neoprene panel adhesive or structural silicone glazing sealant, as recommended by solid surfacing manufacturer.
- D. Sealant for joints between countertops and dissimilar materials with backing materials as specified in Section 07 92 00 - JOINT SEALANTS.
  - 1. Joint Sealer Type SM (Silicone, Mildew-resistant): USDA approved one component acetoxy silicone rubber, mildew resistant, acceptable to local health officials, conforming to U.S. Food and Drug Administration regulation 21 CFR 177.2600, and ASTM C 920, Type S, Class 25, Grade NS, use NT,G and A with a minimum movement capability of  $\pm 25$  percent, and a Shore A hardness of 20, equal to the following:
    - a. BASF (Sonneborn), product "OmniPlus".
    - b. Dow Corning, product "786".
    - c. GE Silicones, product "Sanitary 1700".
    - d. Tremco, product "Tremsil 200 Sanitary".
    - e. Pecora, product "898NST".
- E. Sink/Bowl Mounting Hardware: Manufacturer's approved bowl clips, brass inserts and fasteners for attachment of undermount sinks/bowls.
- F. Bolts, nuts, washers, lags, pins, and screws: Of size and type to suit application chrome finish in exposed-to-view locations.
- G. Concealed supports for edge and corner backing shall be kiln dried birch or poplar.

- H. Heat Reflecting Tape: Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.
- I. Insulating Nomex Fabric: Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

## 2.5 FABRICATION

- A. Coordinate the fabrication of solid surfacing products with that of the various trades responsible for installing materials and items which will be inserted into, or applied to, the countertop surfaces. Obtain and verify templates, dimensions, and instructions from the respective trades before making cut-outs, holes, slots, and other cutting in the countertops.
- B. Shop fabricate all solid surfacing items in strict accordance with the details on the Drawings, the approved shop drawings, and recommendations of the solid surfacing manufacturer
  - 1. Prepare countertops for undermount design sinks furnished and installed under Division 22 - PLUMBING.
  - 2. Prepare solid surfacing fabrications for installation of plumbing fixtures.
- C. Fit corners and joints hairline. Make all field joints and miters tight, secure with concealed fasteners.
- D. Provide shop fabricated counters, shop mitered components, closure trims with ample allowance for field cutting and fitting. Provide additional trim as required for scribing and site cutting.
- E. Where indicated, thermoform corners and edges or other objects to shapes and sizes indicated on Drawings, prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.
- F. Route all edges to be butted for a smooth, clean fit. Sand edges with 120 grit sandpaper to rough up surfaces for adhesive bonding. Clean with denatured alcohol.
- G. Prepare and apply adhesive in compliance with manufacturer's written instructions. Clamp all components using manufacturer's approved clamping methods at all joints and build-up laminations, maintain clamping until adhesive is set. Avoid over-tightening clamps and squeezing out adhesive.
- H. Remove excess adhesive when dry with router. Follow with belt sander using 120 grit, diagonal to joint. After adhesive is leveled and smooth with surface, proceed with final shaping and finishing.
- I. After shaping, smooth finish of cut surfaces equal to manufacturer's original finish. Sand surfaces smooth with wet 400 grit sandpaper. Remove superficial scratches and sander markings, buff with nylon buffing pads as recommended by solid surfacing manufacturer. Wipe surfaces clean and dry with cloths.
- J. Finished work shall be free from visible adhesive and pencil marks.



- K. Field touch-up: Shall be the responsibility of the installer and shall include the filling, and touch-up of exposed job made nail or screw holes, refinishing of surfaces resulting from job fitting, repair of job inflicted scratches and marks, and final cleaning up of the finished surfaces.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION - GENERAL**

- A. General: Install work in accordance with manufacturer's instructions.
- B. Solid surfacing shall be installed plumb, level, true and straight without distortions:
  - 1. Use concealed shims as required
  - 2. Work shall be installed to a tolerance of 1/8 inch in 8 feet for plumb and levelness, including tops.
  - 3. There shall be no variations in flushness of adjoining surfaces.
- C. Tops and trim shall be scribed and trimmed to fit adjoining work.
  - 1. Where cuts occur, refinish surfaces and repair damaged finishes
- D. Secure solid surfacing fabrications to blocking directly attached to substrates.
  - 1. Secure fabrications using concealed fasteners.
  - 2. Anchor tops securely to base units and to other support systems as required.
- E. After installation and leveling of solid surfacing fabrications has been completed; apply a continuous bead of specified sealant to all joints which abut walls or partitions. Tool the sealant to a uniformly dense surface, level with the edges of the casework. Immediately remove all excess sealant from solid surfacing surfaces.

#### **3.2 TOLERANCES**

- A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.

#### **3.3 CLEANING**

- A. Daily clean work areas by sweeping and disposing of scraps.
- B. Clean excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant and solid surfacing manufacturers.
- C. Wash down exposed surfaces with a solution of mild detergent in warm water, applied with soft clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

#### **3.4 PROTECTION**

- A. Protect installed fabrications in a manner acceptable to fabricator and installer, which shall ensure no damage or deterioration at the time of Final acceptance of Project by the Architect.

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Section 07 13 53

ELASTOMERIC SHEET WATERPROOFING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Adhered Vertical Waterproofing: Self-adhesive sheet membrane vertical waterproofing applied to exterior surfaces of existing below-grade masonry walls.
    - a. Prefabricated composite drainage board over membrane waterproofing system.
- B. Factory representative field inspections of installed waterproofing.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 07 16 16 - CRYSTALLINE WATERPROOFING.
- D. Division 31 - EARTHWORK: Placement of backfill against sheet membrane waterproofing.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ACI 515 - Guide to the Use of Waterproofing, Dampproofing, and Protective and Decorative Barrier Systems for Concrete.
  - 2. ASTM C578 - Preformed Cellular Polystyrene Thermal Insulation.
  - 3. ASTM C836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

4. ASTM C898 Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane With Separate Wearing Course.
  5. ASTM D146 - Sampling and Testing Felted and Woven Fabrics Saturated with Bituminous Substances for Use in Waterproofing and Roofing.
  6. ASTM D412 - Standard Test Methods for Rubber Properties in Tension.
  7. ASTM D570 - Standard Test Method for Water Absorption of Plastics.
  8. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
  9. ASTM D1079 - Standard Terminology Relating to Roofing and Waterproofing.
  10. ASTM D1434 - Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting.
  11. ASTM D1682 - Test Methods for Breaking Load and Elongation of Textile Fabrics.
  12. ASTM D1876 Standard Test Method for Peel Release of Adhesives (T-Peel).
  13. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
  14. ASTM D3767 - Standard Practice for Rubber - Measurements of Dimensions.
  15. ASTM D3787 - Test Method for Bursting Strength of Knitted Goods: Constant Rate of Traverse (CRT), Ball Burst Test.
  16. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
  17. ASTM D5385 - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.
  18. ASTM E96 - Tests for Water Vapor Transmission of Materials in Sheet Form.
  19. ASTM E154 - Testing Materials for Use as Vapor Barriers Under Concrete Slabs and as Ground Cover in Crawl Spaces.
- B. General References The following reference materials are hereby made a part of this Section by reference thereto:
1. International Concrete Repair Institute (ICRI) Technical Guideline No. 03730 - Surface Preparation Guidelines for the Repair of Deteriorated Concrete Resulting From Reinforcing Steel Corrosion.
  2. International Concrete Repair Institute (ICRI) Technical Guideline No. 03732 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
- C. Definitions:
1. “Low Temperature”: The term “Low Temperature” is used herein for purposes of defining selection of appropriate waterproofing products which are manufactured for use in a specific temperate range. “Low Temperature” products are appropriate in ambient and substrate conditions which are below 40° F. (5° C.) and above 25° F. (-4° C.).

## 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
  - 1. Required attendees: Owner, Architect, Contractor, Waterproofing Applicator's Project Superintendent, waterproofing manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work.
  - 2. Agenda:
    - a. Scheduling of demolition and waterproofing operations.
    - b. Review of staging and material storage locations.
    - c. Coordination of work by other trades.
    - d. Protection of completed waterproofing.
    - e. Establish weather and working temperature conditions to which Architect and Contractor must agree.
    - f. Emergency rain protection procedure.
    - g. Establish conditions for which a temporary waterproofing will be provided by the Contractor.
    - h. Mock-up requirements.
    - i. Manufacturer's pre-installation deck inspection to be performed.
    - j. Flood testing procedures.
    - k. Substrate conditions, and procedures for substrate preparation and waterproofing installation.
    - l. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.
- C. Sequencing: Coordinate the work of this Section with the respective trades responsible for installing work concealed by waterproofing.
  - 1. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after concrete substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties.
  - 2. Shop Drawings:

- a. Provide large scale details of all termination and transition details, penetrations, and drainage composite.
  - 1) Indicate special joint or termination conditions of Interface with other materials, including penetrations, inside/outside corners, tie-ins with adjoining waterproofing, and other relevant conditions.
- b. Provide large scale details of crack treatment in concrete substrate.
3. Verification Samples:
  - a. 24 by 24 inch samples of each type of sheet membrane waterproofing.
  - b. Minimum 24 inch samples of transition of sheet membrane with adjacent waterproofing, and air barrier membrane.
4. Test and Evaluation Reports: Submit manufacturer's test reports of in-place testing performed by an independent testing agency.
5. Manufacturer's Pre-Warranty Certification: Manufacturer's written certification that shop drawings and proposed systems and components have been reviewed and accepted by the manufacturer for the specified manufacturer's warranty.
6. Manufacturer's Instructions: Manufacturer's application instructions including data for surface conditioners, joint and crack treatment and application temperature range.
7. Applicator Reports:
  - a. Review statement: Written statement, signed by the waterproofing applicator, stating that the Contract Drawings have been completely reviewed with an agent of the waterproofing system manufacturer; accompanied by a written statement from the manufacturer that the selected sheet membrane waterproofing system is proper, compatible, and adequate for the application shown.
    - 1) The waterproofing applicator will notify the Architect and Owner in writing that the existing conditions when exposed are in conflict with the Contract Documents for the proper application of the selected waterproofing system or the warranty requirements.
8. Manufacturer Reports: Submit manufacturer's representative's field inspections reports.
9. Qualification Submittals:
  - a. Workmen Qualifications: Statement of qualifications for on-site supervisor, as required under the Article entitled "Quality Assurance" specified herein below, include certifications of workers who have completed a installation training program.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
  1. Bonds and Warranty Documentation: Manufacturer's and Applicator's warranties, include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

## 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1. Field Supervised Work: Contractor shall notify Architect before beginning work of this Section. Obtain Architect's approval of Contractor's procedures before proceeding with the work.
  - B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of waterproofing system.
  - C. Qualifications:
    1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, trained and authorized by product manufacturer.
      - a. Qualifications of on-site supervisor (foreman): Minimum 5 years experience in successful application of specified waterproofing system, fully trained, and authorized by the waterproofing manufacturer.
  - D. Manufacturer's On-site Inspections: Make arrangements to have Manufacturer's representative (employed by manufacturer) be present on-site during the Work of this Section at key points, which include, but are not limited to:
    1. Pre-installation conference.
    2. Review of installation procedures (a minimum of 2 site visits are required).
    3. Inspection of installation prior to flood testing.
  - E. Third-Party Inspections: Make arrangements to have Owner's Third-Party Inspector to be present on-site during the Work of this Section.
    1. Waterproofing manufacturer is required to review qualifications of Owner's Third-Party Inspector and if deemed acceptable, manufacturer will certify acceptable in writing.
  - F. Preconstruction Testing: Applicator's review statement that in-situ conditions are acceptable for application of waterproofing system.
- 1.8 MOCK-UPS
- A. Provide mock-up under provisions of Section 01 43 39 – MOCK-UPS.
    1. General vertical waterproofing mockup minimum 60 square feet of horizontal waterproofing with a not less than a 2 foot length vertical transition. Mockup to represent finished work including internal and external corners, seam jointing, attachment method, and counter-flashing.
  - B. Workmen preparing mock-ups shall be same as those performing the work.
  - C. Accepted mock-up may remain as part of the work; the number of mock-ups shall not be restricted.
    1. Protect mock-up from dust, soiling and damage until Project Substantial Completion.
    2. Mock-ups not approved shall be removed in their entirety down to substrate.
- 1.9 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  2. Deliver and store waterproofing materials in new, sealed, containers showing manufacturer's identification, year of production, net weight, date of packaging, and location of packaging.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  2. General: Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
    - a. Store all materials in an elevated, dry location, protected by waterproof coverings.
    - b. Protect materials from freezing.
    - c. Store liquid products in a well ventilated area having a minimum ambient temperature of 40 degrees Fahrenheit and a maximum of 80 degrees Fahrenheit. Protect primers, mastic and adhesives from high heat, flames or sparks.
  3. Do not use the sanitary system for mixing or disposal of refuse material. Carry water to mixing rooms and dump waste material in a suitable refuse receptacle.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.
- 1.10 SITE CONDITIONS
- A. Maintain ambient temperatures above 40 degrees Fahrenheit for 24 hours before and during application and until liquid or mastic accessories have cured.
- 1.11 WARRANTY
- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Manufacturer's Warranty: Provide 10 year Manufacturer's warranty which shall include replacement of defective materials. (Conditional on using a Factory trained applicator), and Third-Party Inspection by Owner retained inspector.
- C. Applicator's Special Warranty (with Extended Correction Period: Furnish to Owner a 3 year Applicator's material and workmanship guarantee or labor/performance bond which provides a guarantee to repair or replace work which leaks or otherwise fails to perform as required due to failures of materials or workmanship. Special Warranty with Extended Correction Period shall include removal and replacement of defective materials, (including burden materials), and repairs or replacement of Owner's materials and products damaged due to failure of waterproofing installation to resist water or moisture penetration.



1. If, within the Applicator's special warranty term, any work related to waterproofing systems under the work of this Section is found to be defective or otherwise not in accordance with Contract Documents, the Applicator shall correct all discovered defects at no cost to Owner.
2. Applicator's special warranty shall be effective upon Project Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Specified manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on GCP Applied Technologies Inc., ("GCPAT") Cambridge MA.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  1. Carlisle Coatings and Waterproofing, Inc., Wylie, TX., ("Carlisle").
  2. GCP Applied Technologies Inc., Cambridge MA., ("GCPAT").
  3. Henry Company, El Segundo CA., ("Henry").
  4. Polyguard Products Inc. Ennis, TX., ("Polyguard").
  5. W.R. Meadows, Hampshire, IL., ("Meadows").

### **2.2 ADHERED VERTICAL WATERPROOFING**

- A. Basis of Design (Specified Product): GCP Applied Technologies Inc., Cambridge MA., ("GCPAT") product: "Bituthene 3000".
  1. Acceptable Manufacturers/Products: Subject to compliance with the requirements specified herein, similar sheet waterproofing products include the following:
    - a. Carlisle, product "MiraDri 860/861".
    - b. GCPAT, product "Bituthene 3000".
    - c. Henry, product "Blueskin WP 200".
    - d. Polyguard, product "Polyguard Underseal PRM".
    - e. Meadows, product "Mel-Rol".
- B. Sheet membrane: Prefabricated composite sheet, minimum of 60 mils thick, consisting of 56 mils thickness of rubberized asphalt and 4 mils thick cross-laminated polyethylene film, self-adhering after removal of release paper, and furnished in 36 or 48 inch wide rolls, formulated for anticipated ambient temperature, and meeting or exceeding the specified physical properties.
- C. Waterproofing Membrane Physical Properties:
  1. Flexibility: Unaffected when tested by ASTM D 1970 at -25 degrees F.
  2. Tensile strength for membrane, as per ASTM D 412, modified: 300 pounds per square inch, minimum.

3. Tensile strength for film, as per ASTM D 412, modified: 5,000 pounds per square inch, minimum.
  4. Elongation, as per ASTM D 412, modified: 300 percent, minimum.
  5. Cycling over crack at minus 25 degrees Fahrenheit: No effect at 100 cycles.
  6. Peel adhesion, when tested per ASTM D 903 (modified) for 7 days dry at 70 degrees Fahrenheit and 120 degrees Fahrenheit and for 7 days wet at 70 degrees Fahrenheit: 7.5 pounds per inch width, minimum.
  7. Puncture resistance for membrane, (ASTM E 154): 40 pounds, minimum.
  8. Resistance to hydrostatic head of water when tested per ASTM D 5385: 200 feet of water, minimum.
  9. Exposure to fungi in soil for 16 weeks, as per GSA-PBS 07111: Unaffected.
  10. Permeance as per ASTM E 96, Method B: 0.05 perms (grains/sq. ft./hr./in. Hg), maximum.
  11. Water absorption, as per ASTM D 570: 0.2 percent by weight, maximum.
- D. Primer: Rubber based low VOC content primer formulated with high solids content which shall comply with regulatory VOC requirements.
1. Carlisle:
    - a. Conventional use: CCW-702.
    - b. Low temperature: CCW-702LT.
    - c. Green or damp concrete: CCW-715.
  2. GCPAT:
    - a. Conventional use: WP-3000.
    - b. Low temperature: B2.
    - c. Green or damp concrete: B2.
  3. Henry:
    - a. Conventional use: Aquatac.
    - b. Low temperature: Blue Skin Adhesive.
    - c. Green or damp concrete: No available product.
  4. Polyguard:
    - a. Conventional use: "Polyguard 650 LT Liquid Adhesive" or "Polyguard California Sealant".
    - b. Low temperature: "Polyguard 650 LT Liquid Adhesive".
    - c. Green or damp concrete: No available product.
  5. Meadows:
    - a. Conventional use: Mel-Prime.
    - b. Low temperature: Mel-Prime VOC.
    - c. Green or damp concrete: No available product.

### 2.3 ACCESSORIES

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with elastomeric waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Drainage Composite Board: Prefabricated geocomposite drainage mat consisting of a formed polystyrene or PVC hollow-studded core with one side bonded with a woven or non-woven polypropylene filter fabric, which is compatible to waterproofing manufacturer. Drainage composite shall be designed to promote positive drainage while serving as a protection course.
  1. GCPAT, product series "Hydroduct" drainage composites:
    - a. Vertical applications, GCPAT product: 220.
      - 1) Thickness: nominal 7/16 inch thick [11 mm].
      - 2) Compressive Strength: 15,000 psf (tested per ASTM D1621).
      - 3) Maximum flow rate: 17 gallons per minute per square foot flow (tested per ASTM D 4716).
  2. Carlisle, product series "CCW MiraDRAIN" drainage composites.
    - a. Vertical applications: Carlisle "CCW MiraDRAIN 6000".
      - 1) Thickness: nominal 0.40 inch thick [10.16 mm].
      - 2) Compressive Strength: 15,000 psi (tested per ASTM D1621).
      - 3) Maximum flow rate: 15 gallons per minute per square foot flow (tested per ASTM D 4716).
  3. Henry, product series "DB" drainage composites.
    - a. Vertical applications, Henry product: "DB 500". (7/16 inch thick, 15 gallons per minute per square foot flow).
  4. Polyguard, product series "Polyflow" drainage composites:
    - a. Vertical applications, Polyguard product: Polyflow 15 Drainage Mat". (1/2 inch thick, 16 gallon per minute flow).
  5. Meadows, product series "Mel-Drain" drainage composites.
    - a. Vertical applications, Meadows product: "5035". (7/16 inch thick, 16 gallons per minute per square foot flow).
- C. Termination Bars: As recommended by manufacturer, type 300 series stainless steel bars, 1/8 inch thickness minimum, by nominally 1 inch width (25 by 3 mm), predrilled at 9 inch (229 mm) centers.
- D. Sheet strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as positive-side self-adhering sheet waterproofing.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Primers, Sealants, crack filler, mastics, liquid detailing compound, tape, and adhesives: As recommended by the waterproofing manufacturer.
  1. Primer, as recommended for substrate conditions by waterproofing manufacturer: Rubber based low VOC content primer formulated with high solids content which shall comply with regulatory VOC requirements.
  2. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

3. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  1. Verify items which penetrate surfaces to receive waterproofing are rigidly installed.
  2. Verify surfaces are free of cracks, depressions, waves, or projections which may be detrimental to successful installation.
  3. Beginning of installation means acceptance of existing substrate and project conditions.
- B. Preinstallation Testing: Verify concrete substrate has been cured and is sufficiently dry in accordance with the waterproofing manufacturer's recommended application requirements.
- C. Evaluation and Assessment:
  1. Notify the Contractor in writing if concrete substrate requires patching of holes over 1/2 inch in diameter or length and over 1/4 inch deep, by Section 03 30 00 - CAST-IN-PLACE CONCRETE. Do not proceed until patching is completed.
  2. Do not apply waterproofing to damp, frozen, dirty, dusty or surfaces unacceptable to membrane manufacturer.

#### **3.2 PREPARATION**

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect existing finished materials and products against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- B. Substrate Preparation – new concrete: Prepare concrete substrate according to ASTM D5295
  1. Cast-in-place concrete must be smooth, and free of unapproved curing compounds, form release agents and other surface contaminants.
  2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
  3. Repair bugholes over 1/2 inch in length and 1/4 inch deep and finish flush with surrounding surface.
  4. Remove scaling to sound, unaffected concrete and repair exposed area.
  5. Grind irregular construction joints to suitable flush surface using mechanical or chemical methods described in the referenced standard.
  6. Test concrete surfaces as described in the referenced standards to verify that the surfaces are ready to receive the adhesive bonded waterproofing membrane

- C. Substrate preparation – existing masonry and concrete:
  - 1. Remove all soil material from surfaces to receive membrane.
  - 2. Remove high spots greater than 1/8 inch in height.
  - 3. Fill surface irregularities and voids greater than 1/2 inch in depth with mortar, or pre-treat with fluid applied membrane.
- D. Cracks and joints in substrate surface must be properly sealed with joint filler and sealant as recommended by the sheet membrane waterproofing manufacturer.

### 3.3 INSTALLATION – GENERAL

- A. Apply waterproofing system in strict accordance the manufacturer's installation specifications, Contract Document details, approved shop drawings and the recommendations of Manufacturer's on-site technical representative, and as additionally specified herein.

### 3.4 INSTALLATION WATERPROOFING SYSTEM 2 - BLIND-SIDE VERTICAL WATERPROOFING

- 1. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet membrane and firmly secure with detail tape.
- 2. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners.
- 3. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.

### 3.5 INSTALLATION ADHERED VERTICAL WATERPROOFING

- A. Primer: Where sheet membrane is to be applied, apply primer as recommended by manufacturer at a rate of 250 to 350 square feet per gallon; areas not covered with membrane in 24 hours must be reconditioned.
- B. General: Perform the application of the sheet membrane waterproofing system in strict accordance with the manufacturer's installation specifications, details, and recommendations, and as specified herein.
  - 1. At all external and internal corners, apply a continuous strip of sheet membrane, at least 12 inches wide, centered on the axis of the corner, before the general application of the membrane.
  - 2. Apply 8 inch wide strips of the sheet membrane over all cracks greater than 1/16 inch in width.
  - 3. Apply a double layer of the sheet membrane around all penetrations in the surface. Apply a bead of compatible sealant between the top layer of membrane and the clamping rings of penetrating items and at all terminations.
  - 4. Apply the sheet membrane in strips of 8 feet in length or less. Off-set end laps a minimum of 6 inches. Weather-lap joints on vertical/sloped substrate in direction of drainage, overlapping edge seams at least 2-1/2 inches. Stagger all end laps. Roll the entire surface of the membrane firmly and completely, as soon as possible after application thereof. Seal all tee joints at the end of each

working day. Seal all daily terminations, and permanent terminations with manufacturer's recommended sealant material.

- C. After application of membrane is completed, carefully inspect the entire waterproofed surface for defects therein. Patch tears and inadequately lapped seams with membrane material. Slit fishmouths, repair with a patch extending at least 6 inches in all directions from the slit, and seal all edges of the patch with manufacturer's recommended sealant.
- D. Arrange for inspection of waterproofing system by representative of waterproofing manufacturer, prior to installation of insulation and backfill. Schedule and sequence manufacturer's inspection in manner to prevent delays in construction schedule. Correct deficiencies in or remove waterproofing that does not comply with requirements, repair substrates and re-apply waterproofing and repair sheet flashings.
- E. Immediately install protection course with butted joints over waterproofing.

### 3.6 INSTALLATION OF ACCESSORIES

- A. Application - Drainage Composite Board (Vertical Application).
  - 1. Apply drainage composite board in a manner acceptable by the membrane manufacturer and as recommended by the composite board manufacturer and following the general guidelines specified herein.
  - 2. Install composite drainage board on same day sheet membrane waterproofing is applied.
  - 3. Apply first row of drainage composite board horizontally starting at base of foundation, peel fabric back approximately 12 inches from the lower edges, tuck exposed drain core behind perimeter subdrainage pipe installed under Section 33 46 00 - SUBDRAINAGE and wrap fabric over pipe.
  - 4. Adhere drainage composite to membrane as recommended by membrane manufacturer.
  - 5. Apply subsequent rolls of drainage composite butted tightly to previous row, overlapping fabric over next lowest row.
  - 6. At inside corners, cut backing but not fabric. At outside corners cut backing and fabric and overlay with second layer of fabric, adhered.
  - 7. Terminate composite board system at 6 inches below finish grade.
  - 8. Patch or replace any damage to fabric prior to backfilling.

### 3.7 FIELD QUALITY CONTROL

- A. Field inspection will be performed under the general provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Owner's testing: At the Owner's discretion, Owner will engage a third-party testing agency to perform observations of waterproofing assembly, including periodic inspections during installation, and inspection of completed work.
  - 1. Testing agency will perform pull tests to ensure adhesion with substrate.

2. Testing agency will perform test cuts through seams and joints for representative samples of workmanship. Up to 12 test cuts may be performed.
  - C. Manufacturer Services: Submit to Architect manufacturer's final acceptance report following inspection of installed waterproofing within 14 calendar days following inspection.
  - D. Remove and replace applications that do not comply with specified requirements.
  - E. Do not cover materials until Owner's testing agency and manufacturer's representative has completed all inspections, and all repairs to damage and defective waterproofing has been completed.
- 3.8 CLEANING
- A. Clean all finished surfaces which have been damaged by the work of this Section.

3.9 PROTECTION

- A. Protect applied sheet membrane waterproofing and composite drainage board fabric from damage by other trades, construction materials or backfill.
- B. Do not permit foot or vehicular traffic on unprotected membrane.
- C. Protect waterproofing from damage and wear during remainder of construction period.
- D. Protect installed insulation from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

End of Section

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Section 07 16 16  
CRYSTALLINE WATERPROOFING

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Prepare surfaces and repair cracks in substrate scheduled to receive waterproofing. Seal active leaks.
- B. Furnish and install the following:
  - 1. Crystalline waterproofing system, applied as coating to the negative side of walls and floor construction in elevator hoistway pits, sump pits, and other mechanical pits.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 03 30 00 – CAST-IN-PLACE CONCRETE: formwork, waterstops, and finishing concrete walls and slabs to receive waterproofing.
- D. Section 07 92 00 – JOINT SEALANTS: elastomeric and preformed sealants in concrete and masonry walls and floors.
- E. Section 09 91 00 – PAINTING: Field applied paint finishes.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM C 1247 - Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing: Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after concrete and masonry substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
- C. Scheduling: Schedule cleaning and surface preparation so dust and other contaminants from the cleaning and preparation process will not fall on wet, newly coated surfaces.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  1. Product Data: Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
  2. Certificates: Manufacturer's written certification stating that waterproofing systems and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section, and that the applicator is qualified and approved to install the materials in accordance with manufacturer's product data.
  3. Test and Evaluation Reports: Submit for acceptance, complete test reports from approved independent testing laboratories certifying that waterproofing system conforms to performance characteristics and testing requirements specified herein.
  4. Manufacturer's Instructions: Manufacturer's installation instructions indicating special procedures, and perimeter conditions requiring special attention.
  5. Field Quality Control Submittals:
    - a. Manufacturer's Field Report: Provide copy of report from manufacturer's representative confirming that the surfaces to which waterproofing material is to be applied are in a condition suitable to receive same
  6. LEED Submittal Requirements:
    - a. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
      - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
        - a) The exposure scenario used to determine compliance.
        - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more

- c) Laboratory accreditation under ISO/IEC 17025.
        - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
      - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
      - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.
    - B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
      - 1. Bonds and Warranty Documentation:
        - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.
- 1.7 QUALITY ASSURANCE
- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
  - B. Sole Source: Obtain crystalline waterproofing products and accessories required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of crystalline waterproofing.
  - C. Qualifications:
    - 1. Installer/Applicator: Minimum of 5 years documented experience demonstrating previously successful work of the type specified herein.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:
    - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
    - 2. Deliver materials in original packages, containers or bundles bearing brand name, identification of manufacturer or supplier.
  - B. Storage and Handling Requirements:
    - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
    - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- 1.9 SITE CONDITIONS
- A. Proceed with waterproofing work only if ambient temperature is above 40 degrees Fahrenheit for 24 hours before and during the work, and for full time required for curing.
  - B. Ensure work areas are well ventilated and kept free of water.
-

## 1.10 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manufacturer Warranty:
  - 1. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
  - 1. The Euclid Chemical Company, Cleveland OH. (Euclid)
  - 2. Vandex USA, Levittown PA. (Vandex)
  - 3. Xypex Chemical Corporation, Richmond, BC, Canada. (Xypex)

### 2.2 PERFORMANCE/DESIGN CRITERIA

- A. Testing Requirements: Crystalline waterproofing system shall be tested in accordance with the following standards and conditions, and the testing results shall meet or exceed the performance requirements as specified herein.
- B. Independent Laboratory: Testing shall be performed by an independent laboratory meeting the requirements of ASTM E 329-95 and certified by the United States Bureau of Standards. Testing laboratory shall obtain all concrete samples and waterproofing product samples.
- C. Crystalline Penetration: Crystallizing capability of waterproofing material shall be evidenced by independent SEM (Scanning Electron Microscope) photographs documenting penetration of crystal-forming waterproofing material to a depth of 2 inches (50 mm).
- D. Permeability: Independent testing shall be performed according to U.S. Army Corps of Engineers CRD C48-73 "Permeability of Concrete".
  - 1. Concrete samples (treated and untreated) to have design strength of 2000 psi (13.8 MPa) and thickness of 2 inches (50 mm). No admixtures permitted.
  - 2. Coatings to have maximum thickness of 0.05 inches (1 mm) per coat with up to two coats permitted.
  - 3. Samples to be pressure tested to 175 psi (405 foot head of water) or 1.2 MPa (123.4 m head of water).

4. Treated samples, after crystalline growth has occurred, shall exhibit no measurable leakage.
- E. Chemical Resistance: Independent testing shall be performed according to ASTM C 267-77 "Chemical Resistance of Mortars" and ASTM C 39-86 "Compressive Strength of Cylindrical Concrete Specimens".
1. Concrete samples (treated and untreated) to have design strength of 4000 psi (27.6 MPa). No admixtures permitted.
  2. Coatings to have maximum thickness of 0.05 inches (1 mm) per coat with up to two coats permitted.
  3. Untreated and treated specimens to be immersed for a minimum of 84 days in following chemical solutions: hydrochloric acid (3.5pH), brake fluid, transformer oil, ethylene glycol, toluene, caustic soda.
  4. Treated specimens shall exhibit no detrimental effects after exposure, and shall have a minimum of 14% increase in compressive strength versus untreated control specimens.
- F. Potable Water Approval: Independent testing shall be performed according to NSF Standard 61 and approval for use of waterproofing material on structures holding potable water shall be evidenced by NSF certification.

### 2.3 CRYSTALLINE WATERPROOFING:

- A. Crystalline Waterproofing: A blend of portland cement, specially treated sand, and active chemicals formulated to penetrate by capillary action into concrete or masonry and to chemically react with free lime in the presence of water to develop crystalline growth within concrete or masonry capillaries.
1. Minimum properties:
    - a. Permeability: 30 feet (9 m) when tested according to CE CRDC 48.
    - b. Compressive Strength: 9000 psi (62.1 MPa) at 28 days when tested according to ASTM C 109/C 109M.
    - c. Flexural Strength: 6000 psi (41.4 MPa) at 28 days when tested according to ASTM C 348.
    - d. Bond Strength: 690 psi (4.8 MPa) at 14 days when tested according to ASTM C 321.
  2. Acceptable Products:
    - a. Euclid, product: "Hey'Di K-11".
    - b. Vandex, product: "Vandex Super".
    - c. Xypex, product: "Xypex".
- B. Patching Compound: Ready-mixed cementitious waterproofing and repair mortar for filling and patching tie holes, honeycombs, reveals, and other imperfections with properties meeting or exceeding the following:
1. Compressive Strength: 7600 psi (52.44 MPa) at 28 days when tested according to ASTM C 109/C 109M.
  2. Flexural Strength: 710 psi (4895 kPa) at 28 days when tested according to ASTM C 348.

3. Shrinkage: Minus 0.093 percent at 28 days and plus 0.073 percent at 90 days when tested according to ASTM C 596.
- C. Plugging Compound: Cementitious, ready-mixed, efflorescence-free, surface waterproofing compound with hydrophobic properties that requires only the addition of water, and is resistant to water and moisture but is vapor permeable for all standard applications (vertical, overhead and horizontal surfaces not exposed to vehicular traffic); with properties meeting or exceeding the following criteria:
1. Permeability: 30 feet (9 m) when tested according to CE CRDC 48.
  2. Compressive Strength: 6000 psi (41.4 MPa) at 28 days when tested according to ASTM C 109/C 109M.
  3. Flexural Strength: 1000 psi (6.9 MPa) at 28 days when tested according to ASTM C 348.
  4. Bond Strength: 300 psi (2.1 MPa) at 14 days when tested according to ASTM C 321.

## 2.4 ACCESSORIES

- A. Joint Sealer Type "PS" (Polysulfide Rubber Sealant): Two-component non-sagging gun grade, low-VOC, activated cure polysulfide rubber sealant, conforming to FS TT-S-000227E, Type II, Class A (excluding Section 3.5.7 stain and color change), and ASTM C 920, Type M, Grade NS, Class 25, use NT, M, G and A with a minimum movement capability of  $\pm 25$  percent. Sealant shall additionally exceed the test requirements of ASTM C1247 for continuous immersion service in liquids and comply with NSF Standards 61, Section 6.
1. Tested properties:
    - a. Percent Solids as tested per ASTM C 1250: 100 percent.
    - b. VOC with activator: 20g/L.
    - c. Joint Movement as tested per ASTM C 1250: plus or minus 25 percent.
    - d. Hardness (Shore A) as tested per ASTM C 1250: 25 to 30.
    - e. Elongation as tested per ASTM D 412: 500 to 550 percent.
    - f. Tensile Strength as tested per ASTM D 412: 150 to 200 psi.
    - g. 100 percent Modulus as tested per ASTM D 412: 50 psi.
    - h. 200 percent Modulus as tested per ASTM D 412: 80 psi.
  2. Acceptable products are limited to the following:
    - a. Pecora Corporation, Harleysville PA.; product "Synthacalk GC 2+".
      - 1) Required Primer for immersion service, Pecora Corporation, product "Synthacalk P53+ Primer".

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Applicator shall review for compliance with requirements for surface preparation, cleaning, and other conditions affecting waterproofing performance.

1. Proceed with application only after unsatisfactory conditions have been corrected.
2. Beginning of installation means acceptance of existing substrate and project conditions.

### 3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- B. Provide temporary enclosure to confine operation, to prevent polluting the air, and to ensure adequate ambient temperatures and ventilation conditions for application.
- C. Stop active water leaks with plugging and patching compounds according to waterproofing manufacturer's written instructions.
- D. Surface Preparation:
  1. General: Mask-off surfaces adjoining areas to receive waterproofing treatment where surface damage or discoloration might result from application of waterproofing. Do not allow crystalline waterproofing or crystalline compound to migrate into reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves, unless indicated to be filled with caulking.
  2. Surface Preparation of Concrete: Comply with waterproofing manufacturer's written instructions and requirements indicated below to ensure that waterproofing bonds to concrete surfaces. Clean concrete surfaces according to ASTM D 4258 by using one or a combination of procedures as needed to effectively remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, curing compounds, and form-release agents.
    - a. Prepare scratch- and float-finished concrete by etching with 10 percent muriatic (hydrochloric) acid solution.
    - b. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning.
    - c. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.
    - d. At cracks in concrete, remove loosened chips and cut square reveal approximately 1 inch (25 mm) deep.

### 3.3 APPLICATION

- A. General: Comply with waterproofing manufacturer's written instructions, unless more stringent requirements are indicated.
- B. Mix waterproofing components according to waterproofing manufacturer's written instructions.

- C. Protect all adjacent surfaces. Dampen wall surface with water before applying waterproofing.
- D. Apply waterproofing coating evenly and fill voids and pores of substrate with waterproofing slurry. Keep tools clean and free from build-up.
- E. Apply the number of coats at the rates recommended by the manufacturer for each coat. After allowing previous coat to cure, dampen the wall before applying additional coats.
- F. Mist-cure waterproofing for two to three days immediately after application as recommended by the manufacturer.
- G. Waterproofing Treatment Extensions: Apply treatment to columns that are integral with walls to be treated, and extend treatment onto interior, nontreated walls that intersect exterior, treated walls, for a distance of 24 inches (600 mm) for cast-in-place concrete and 48 inches (1200 mm) for masonry. Where floors (but not walls) are treated, extend treatment 12 inches (300 mm) high onto exterior walls and onto both exterior and interior columns. Unless otherwise indicated, extend treatment to every surface of substrate in area indicated for treatment, including stair treads and risers, pipe trenches, pipe chases, pits, sumps, and similar offsets and features.

#### 3.4 INTERFACE WITH OTHER WORK

- A. Do not conceal installed waterproofing system before it has been observed by Architect/Engineer, waterproofing manufacturer's representative and Independent Tank Waterproofing Inspection Laboratory.

#### 3.5 CLEANING

- A. General: Clean work under provisions of Section 01 70 00 – EXECUTION.
  - 1. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of waterproofing mortar and other materials installed under this Section.
    - a. Clean spillage and soiling from adjacent surfaces using appropriate cleaning agents and procedures.
- B. Waste Management: Dispose of liquid waste in accordance with all applicable regulations. Consult all regulations (federal, provincial, state, and local) or a qualified waste disposal firm when characterizing waste for disposal. Contact manufacturer for MSDS sheets for product information, and recommendations for proposal disposal. Utilize licensed waste disposal companies as may be required, the following phone numbers for national companies are provided for the Contractor's convenience only.
  - 1. Safety Kleen 1-888-217-7859.
  - 2. Clean Harbors 1-800-444-4244.
  - 3. Phillip Services 1-888-655-4331.

#### 3.6 PROTECTION

- A. Protect applied crystalline waterproofing from rapid drying, severe weather exposure, and water accumulation. Maintain completed Work in moist condition for



not less than seven days by covering with impervious sheeting or by other curing procedures recommended by waterproofing manufacturer.

- B. Take measures to protect completed coating from damage after application. Do not permit traffic on unprotected coating.

End of Section

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Section 07 21 00  
THERMAL INSULATION

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Thermal batt insulation between roof and attic framing with insulation baffles.
  - 2. Low pressure, low expansion polyurethane foamed-in-place insulation / air barrier sealant: applied to seal gaps, cracks, cavities and joints in the building envelope, at door frames, perimeter of window frames, and other similar penetrations in exterior walls.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing partitions, walls and related insulation.
- D. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, nailers.
- E. Section 07 26 00 - VAPOR RETARDERS:
  - 1. Vapor barriers and in walls, floor assemblies and roof assemblies.
  - 2. Vapor barrier, seam tape, pipe boots, detail strip for installation under concrete slabs.
- F. Section 09 29 00 - GYPSUM BOARD: Installation of wall board over insulation in Z-channel furring system.
- G. Section 09 81 00 - ACOUSTICAL INSULATION: Acoustical batt insulation between framing members.
- H. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Ductwork and piping insulation.

#### 1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. . Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. ASTM C 203 - Breaking Load and Flexural Properties of Block Type Thermal Insulation.
1. ASTM C 518 - Thermal Transmission Properties by Means of the Heat Flow Meter.
  2. ASTM C 553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  3. ASTM C 578 - Preformed Cellular Polystyrene Thermal Insulation.
  4. ASTM C-612 - Mineral Fiber Block and Board Thermal Insulation.
  5. ASTM C665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  6. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
  7. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C.
  8. ASTM E 84 - Surface Burning Characteristics of Building Materials.
  9. ASTM E 96 - Water Vapor Transmission of Materials.
  10. All applicable federal, state and municipal codes, laws and regulations for thermal insulation.
- B. Definitions:
1. The term "R-Value" referred to herein refers to the thermal resistance of the insulation alone and does not allow consideration of air spaces or other factors.

#### 1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
  2. LEED Submittal Requirements:
    - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
      - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
        - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
        - b) EPD shall have at least Cradle to Gate scope,
      - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
    - b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
      - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:

- 
- a) Itemized vendor invoices for FSC-certified products.
  - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
  - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
  - c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
    - 1) Recycled Content:
      - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
      - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
    - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
      - a) Documentation should be in the form of one of the following:
      - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
      - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
      - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
      - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
      - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
    - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
    - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
      - a) The exposure scenario used to determine compliance.
      - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more

- c) Laboratory accreditation under ISO/IEC 17025.
- d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
- 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
- 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (insulation):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:
      - 0.5 mg/m<sup>3</sup> or less;
      - Between 0.5 and 5.0 mg/m<sup>3</sup>; or
      - 5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for flooring systems installed within the waterproofing membrane.

## 1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  - 2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Storage and Handling Requirements:
  - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in packages containing water marks, or show evidence of mold.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Mineral fiber insulation:
    - a. Johns Manville, Inc., Denver CO.
    - b. Roxul, Inc., Milton, Ontario. (Roxul).
    - c. Thermafiber Inc., Wabash IN. (Thermafiber)
  2. Low pressure polyurethane foamed-in-place insulation / air barrier sealant:
    - a. Fomo Products, Inc., Norton OH.
    - b. Dow Chemical Company, Midland, MI.
    - c. Premier industrial Supply, Phoenix AZ.
    - d. Convenience Products, Division of Clayton Corp., Fenton MO.
    - e. Henry Company, El Segundo, CA.

### 2.2 MATERIALS

- A. Semi-rigid mineral wool insulation for exterior wall cavities: mineral wool fiber insulation board, conforming to ASTM C612, Type IVB having a nominal density of 4.4 pounds per cubic foot.
1. Non-Combustible as tested per ASTM E-136.
  2. Flame Spread Classification: Class A (less than 25, per testing by NFPA 255, ASTM E-84 or UL 723), with flame spread rating of 0 and smoke developed rating of 0.
  3. Thermal Resistance: ASTM C518 (C177), R-value of 4.2 per inch.
  4. Thickness: As indicated on Drawings.
  5. Size: 16 inches x 48 inches (406 mm x 1219 mm).
  6. Acceptable products include the following or approved equal:
    - a. Roxul, Inc., Milton, Ontario, product "CavityRock MD".
    - b. Owens Corning, Wabash IN, product "Thermafiber, RainBarrier 45."
    - c. Johns Manville, Inc., Denver CO. product: "MinWool Curtainwall CW4".
- B. Foamed-in-place insulation for air barrier sealant: Low pressure polyurethane foam sealant. Acceptable products include the following or approved equal:
1. Fomo Products, Inc., product: "Handi Foam" or "Handi-Seal".
  2. Dow Chemical Company, product: "Great Stuff Pro".
  3. Premier industrial Supply, product: "XtraFoam".
  4. Convenience Products, Division of Clayton Corp., product: "Touch 'n Foam No Warp".
  5. Henry Company, product: "NailTite NT-100".

## 2.3 ACCESSORIES

- A. Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each insulation type.
- B. Adhesive attached spindle anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
  - 1. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch, minimum 2 inches square.
  - 2. Pin: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
  - 3. Adhesive, as recommended by anchor manufacturer for substrate.
  - 4. Acceptable products include the following, or approved equal to:
    - a. Gripnail Corporation, East Providence, RI, product "SnapStik Spindle Anchors".
    - b. Gemco, Danville, IL, product "Perforated Base Insulation Hangers."
    - c. AGM Industries, Brockton, MA, product: Tactoo Insul-Hangers."
- C. Wire Insulation Supports: 13 gauge spring type wire with sharp ends designed to hold batt insulation in place between joists/rafters. Provide wire lengths based on joist/rafter spacing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Beginning of installation means acceptance of existing substrate and project conditions.

### 3.2 INSTALLATION

- A. Mineral Fiber insulation in exterior wall cavities:
  - 1. Install boards, friction fit, horizontally between wall reinforcement.
  - 2. Install full thickness of insulation over the entire surface to be installed as indicated. Ensure tight fit around penetrating elements and abutting construction. All voids and gaps shall be filled. Minimize potential for thermal bridging.
  - 3. Install insulation hold-down clips as per the manufacturer's recommendations, and in conformance with the Building Code.
  - 4. At completion of each days' work, protect all exposed edges. Seal edges or lap over with a moisture retardant barrier.
- B. Install insulation baffles between roofing framing members scheduled to receive batt/blanket insulation. Install as recommended by baffle manufacturer in manner to provide continuous free flow of air underside of roof sheathing, from bottom of roof to top of roof.



- C. Batt and blanket insulation between framing members:
  - 1. Install in accordance with manufacturer's instructions. Do not compress or "stuff" insulation into voids, compressed insulation has less thermal resistant value.
  - 2. Trim insulation neatly to fit spaces. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation, do not cut around electrical boxes. Leave no gaps or voids.
  - 3. Where faced insulation is specified, apply membrane facing on warm side of building spaces. Lap ends and staple side flanges of membrane between framing members.
  - 4. Where insulation is located between joists/rafters and is not to be covered, install wire insulation supports to keep insulation in place.
  
- D. Batt insulation using spindle type anchors:
  - 1. Install spindle type anchors at 12 inches on center in accordance with manufacturer's instructions using recommended adhesive.
    - a. Thickness of Adhesive should be between 1/23 and 1/16 inch minimum.
    - b. Install baseplate into adhesive; adhesive should protrude through baseplate perforations and beyond edges of base plate.
    - c. Permit spindle adhesive to fully cure before installation of insulation.
    - d. Before installation of insulation, pull, pry or otherwise test sample random anchors to ensure they are fully adhered. Replace all failed anchors.
  - 2. Install insulation in accordance with manufacturer's instructions, with spindle passing through insulation. Secure in place with self locking washers, do not compress insulation. Fit insulation tight to adjacent batts, edge materials and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids
  
- E. Foamed-in-place insulation / air barrier sealant: Apply insulation in method to a uniform monolithic density without voids, in accordance with manufacturer's instructions.
  - 1. Apply application of foam for air barrier seal includes, but is not limited to:
    - a. Door frames, window frames, and similar penetrations in exterior walls.
    - b. Gaps, cracks, cavities and joints in the building envelope, not sealed with other forms of air boots, including electrical boxes and conduit, ducts, fans, and piping.
    - c. Where additionally indicated on Drawings.

### 3.3 CLEANING

- A. Clean work under provisions of Section 01 73 00 – EXECUTION.
- B. Daily clean work areas by sweeping and disposing of debris, and scraps.

End of Section

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Section 07 21 31

CLOSED CELL SPRAYED FOAM INSULATION

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Foamed-in-place insulation in wall cavities.
  - 2. Foamed-in-place insulation at junctions of dissimilar wall and roof materials to achieve a thermal and air seal.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete walls.
- D. Section 07 21 00 - THERMAL INSULATION.
- E. Section 07 81 43 – APPLIED INTUMESCENT IGNITION BARRIER: Applied intumescent non-prescriptive thermal barrier (equivalent thermal barrier) over spray foam plastics.
- F. Section 07 92 00 - JOINT SEALANTS: Requirements for joint sealant and backing materials.
- G. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Ductwork and piping insulation.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM C 177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

2. ASTM C 518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.
3. ASTM C 1029 - Spray Applied Rigid Cellular Polyurethane Thermal Insulation.
4. ASTM D 1621 – Test Method for Compressive Properties of Rigid Cellular Plastics.
5. ASTM D 1622 – Test Method for Apparent Density of Rigid Cellular Plastics.
6. ASTM D 1623 – Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
7. ASTM D 2126 – Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
8. ASTM D 2842 – Test Method for Water Absorption of Rigid Cellular Plastics.
9. ASTM D 2856 – Test Method for Open Cell Content of rigid Cellular Plastics by Air Pycnometer.
10. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C.
11. ASTM D 5116 - Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
12. ASTM E 84 - Surface Burning Characteristics of Building Materials.
13. ASTM E 96 - Water Vapor Transmission of Materials.
14. ASTM E 2176 – Air Barrier Materials.
15. UL - Building Products Directory.
16. CAN/ULC-S705.1-01 Standard for Thermal Insulation - Medium Density Closed Cell Spray Applied Rigid Polyurethane Foam – Material Specification.
17. CAN/ULC-S705.2-05 Standard for Thermal Insulation - Medium Density Closed Cell Spray Applied Rigid Polyurethane Foam – Application.
18. All applicable federal, state and municipal codes, laws and regulations for thermal insulation and vapor barriers.

B. Definitions:

1. The term “AVB” referenced herein refers to “Air and Vapor Barrier” system.
2. The term “ccSPF” referenced herein refers to “Closed Cell Spray Polyurethane Foam” insulation.
3. The "R-Value" referred to herein refers to the thermal resistance of the insulation alone and does not allow consideration of air spaces or other factors.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Pre-installation meetings specified under related specifications:

1. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 04 20 00 – UNIT MASONRY.

2. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 07 27 13 - MODIFIED BITUMINOUS SHEET AIR BARRIERS.

C. Sequencing.

1. Apply spray foam insulation to indicated thicknesses (where located against existing plaster), after removal of interior partitions (specified under Section 02 41 19), and after patching of plaster (specified under Section 09 01 23). Following application of, curing of, and inspection of spray foam, apply intumescent non-prescriptive thermal barrier specified under Section 07 81 43.
2. Enclosure after application of spray foam and thermal barriers may proceed with metal studs and gypsum wall board after spray foam and thermal barrier has been inspected and installation approved.

1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Provide data on material characteristics, performance criteria, and limitations.
  - a. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
  - b. Include statement that materials are compatible with adjacent materials proposed for use.
2. Manufacturer's certifications:
  - a. Provide an Evaluation Report as the manufacturer's documentation confirming material has been evaluated and conforms to the requirements of the ASTM E2176 Standard for Air Barrier Materials.
  - b. Certification from an independent testing laboratory that insulation meets fire hazard classification requirements.
3. Shop Drawings: Developed for specific project conditions including mock-up, submittal of manufacturer's standard details are prohibited.
  - a. Shop Drawings of Mock-Up: Submit shop drawings of proposed mock-ups showing plans, elevations, large-scale details, and connections to the test apparatus.
4. Manufacturers installation instructions: indicate preparation, installation requirements and techniques, product storage and handling criteria, and limitations of the material.
5. LEED Submittal Requirements:
  - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
    - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
      - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
      - b) EPD shall have at least Cradle to Gate scope,

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- 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
    - 1) Recycled Content:
      - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
      - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
    - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
      - a) Documentation should be in the form of one of the following:
      - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
      - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
      - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
      - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
      - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
    - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - c. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
    - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
      - a) The exposure scenario used to determine compliance.
      - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
      - c) Laboratory accreditation under ISO/IEC 17025.
      - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
    - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.

- 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
  - d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (insulation):
    - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
      - a) The exposure scenario used to determine compliance.
      - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
      - c) Laboratory accreditation under ISO/IEC 17025.
      - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
    - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for flooring systems installed within the waterproofing membrane.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Bonds and Warranty Documentation:
    - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

## 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of sprayed foam insulation.
- C. Qualifications:
  1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and a licensed applicator by product manufacturer.
    - a. Provide proof of manufacturer's certification upon request.
- D. Certifications:
  1. Fire Hazard Classification: Maximum flame spread/smoke developed rating of 25/450, tested to ASTM E84.
- E. Manufacturer's Installation Review: Make arrangements to have Manufacturer's representative (employed by manufacturer) on-site during work of this Section to periodically review installation procedures. A minimum of 2 site visits are required.

1.8 MOCK-UPS

- A. Provide mock-ups under provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Provide mock-up areas, each minimum 160 square feet, illustrating application thickness, and demonstrating the minimum standard for the Work.
  - 1. Provide mock-up of spray foam applied against existing plaster to confirm adequate surface preparation and adhesion.
- C. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required. Allow 24 hours for inspection of mock-up by Architect. before proceeding with sprayed foam installation.
- D. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  - 2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
- B. Storage and Handling Requirements:
  - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.10 SITE CONDITIONS

- A. Maintain temperature and humidity recommended by the materials manufacturer for 24 hours before, during, and 48 hours after installation of sprayed foam insulation.
- B. Field Conditions: Do not install spray foam insulation in snow, rain, fog, or mist. Do not install air barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer.

1.11 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Special Warranty:



1. Warrant work of this section against defects or deficiencies for a period of two years from the date work is certified as substantially performed in accordance with general condition of the contract.
2. Promptly correct, at own expense, defects or deficiencies which become apparent within the warranty period.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
1. Demilec (USA) LLC, Arlington, TX., product "Heatlok XT".
  2. Johns Manville Insulation Systems, Denver CO., product "Corbond III".
  3. NCFI Polyurethanes, Inc., Mount Airy, NC., product "InsulStar" spray foam insulation.

### **2.2 DESCRIPTION**

- A. General Description: Plastic resin and catalyst, cold setting low-density, closed-cell foam, two component system.

### **2.3 PERFORMANCE/DESIGN CRITERIA**

- A. General:
1. Air permeability: Not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/sm @ 75 Pa.) when tested according to ASTM E 2178.
  2. All penetrations of the sprayed foam insulation, and paths of air infiltration/exfiltration shall be made airtight.
- B. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds.
- C. Outgassing/Reactivity or Toxicity/Hazardous Materials:
1. Formaldehyde: Products containing urea-formaldehyde will not be permitted.
  2. Chlorofluorocarbons (CFCs)/HCFCs: Products and equipment requiring or using CFCs or HCFCs during the manufacturing process will not be permitted.
- D. Performance criteria: Material shall meet requirements of ULC S705.1, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material - Specification. CCMC Evaluation Report or reports from accredited testing laboratory shall be made available upon request.
1. Long Term Thermal Resistance (LTTR): 6.4 per inch, when tested in accordance with ASTM C518.
  2. Closed cell content: 90 percent minimum when tested in accordance with ASTM D 1940, ASTM D 2856 or ASTM D 6226
  3. Density: Minimum 1.9 pounds per cubic foot minimum when tested in accordance with ASTM D 1622.

4. Compressive Strength: 15 pounds per square inch minimum when tested in accordance with ASTM D 1621.
5. Tensile Strength: 28 pounds per square inch minimum when tested in accordance with ASTM D 1623.
6. Dimensional Stability: 11 percent change in volume maximum at 158 degrees F and 95 percent relative humidity when tested in accordance with ASTM D 2126.
7. Water Absorption: 0.025 (grams per cubic centimeter) when tested in accordance with ASTM D 2842.
8. Air Leakage (for 4 inches of material): ASTM E 283-04; 0.01 L/s/m<sup>2</sup> @ Pa maximum.
9. Sound Transmission Class (STC): ASTM E 90-04; STC 43 minimum.
10. Noise Reduction Coefficient (NRC): ASTM E 90-04; NRC 0.2 minimum.
11. Bacterial or Fungal Growth: Zero rating when tested in accordance with ASTM G 21.
12. Flame Spread and Smoke Developed Rating: Flame Spread <25, Smoke Developed <450 when tested in accordance with ASTM E 84-05.
13. Fuel Contribution: 0 when tested in accordance with ASTM E 84-05.

#### 2.4 EQUIPMENT

- A. Equipment for spraying foam shall be manufactured specifically for the application of polyurethane foam. The equipment shall be airless, capable of maintaining a 1:1 volume ratio and have primary and hose heaters (300 feet of material hose maximum allowable to meet mix pressure requirements.) Acceptable application guns shall include but are not limited to Gusmer GX-7, D Gun, GAP Pro, Fusion, Probler and other direct impingement type mixing guns with low output tips in the 15 pound per minute range or as recommended by the manufacturer.
- B. Equipment settings are to be recorded on the Daily Work Record

#### 2.5 ACCESSORIES

- A. Prime substrate when required by spray polyurethane manufacturer or the membrane manufacturer. The type of primer and the installation of the primer shall follow the requirements of the manufacturer for the surface conditions.
- B. Membrane at Transitions in Substrate and Connections to Adjacent Elements, as acceptable to the spray polyurethane foam air barrier manufacturer:
  1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein and approval with specified foam air barrier (for compatibility), manufacturers offering similar products include the following:
    - a. Henry Bakor Inc., Henry Bakor, Inc., Tadoussac, QC.
    - b. Carlisle Coatings & Waterproofing Inc., Wylie, TX.
    - c. W.R. Grace & Co., Construction Products Division, Cambridge MA.
  2. Sheet membrane: Prefabricated composite sheet 0.9 mm (36 mils) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (4 mils) of cross-laminated, high-density polyethylene film to provide a minimum 1 mm (40 mil)

thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed.

- a. Performance Requirements:
  - b. Water Vapor Transmission: ASTM E 96, Method B - 2.9 ng/m<sup>2</sup>sPa (0.05 perms) maximum.
  - c. Water Absorption: ASTM D 570 - Max. 0.1% by weight.
  - d. Puncture Resistance: ASTM E 154 - 178 N (40 lbs.).
  - e. Tear Resistance:
    - 1) Initiation: ASTM D 1004 - min. 58 N (7.0 lbs.) M.D.
    - 2) Propagation: ASTM D 1938 - min. 40 N (4.0 lbs.) M.D.
  - f. Lap Adhesion at -4 degrees C (25 degrees F): ASTM D 1876 - 880 N/m (5.0 lbs./in.) of width.
  - g. Low Temperature Flexibility: ASTM D 1970 - Unaffected to -43 degrees C (-45 degrees F).
  - h. Tensile Strength: ASTM D 412, Die C Modified, Min. 2.7 MPa (400 psi).
  - i. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D 412 - Die C - Min. 200%.
3. Surface conditioner, liquid membrane tape, crack filler, mastics, and accessories as recommended by the sheet membrane manufacturer and comply with the following:
- a. Description: Latex-based, water-dispersible liquid for substrate preparation.
    - 1) Flash Point: No flash to boiling point.
    - 2) Solvent Type: Water.
    - 3) VOC Content: Not to exceed 350 g/l.
    - 4) Application Temperature: -4 degrees C (25 degrees F) and above.
    - 5) Freeze/Thaw Stability: 5 cycles min.
    - 6) Freezing point (as packaged): -20 degrees C (-5 degrees F).
  - b. Termination Mastic: Rubberized asphalt-based mastic with 200 g/l max. VOC Content.
  - c. Primer: Rubber-based primer in solvent with 680 g/l max. VOC content.
- C. Counterflashing for Masonry Through-Wall Flashing: One of the following and as acceptable to the spray polyurethane foam air barrier manufacturer:
1. CCW-705 TWF by Carlisle Coatings and Waterproofing.
  2. Perm-A-Barrier Flashing by Grace Construction Products.
  3. Blueskin TWF by Henry.
  4. Poly-Wall Crack Guard by Protective Coatings Technology, Inc.
  5. ExoAir TWF by Tremco, Inc.
  6. Detail Strip by W. R. Meadows, Inc.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Report in writing defects in substrates which may adversely affect the performance of the foam insulation.
  - 2. Beginning of installation means acceptance of existing substrate and project conditions.
- B. Evaluation and Assessment: Examine joints before sealing to ensure configurations, surfaces and widths are suitable for foam sealant.

#### **3.2 PREPARATION**

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- B. Surface Preparation - General: Surfaces to receive foam insulation shall be free of frost and loose or foreign matter which might impair adhesion of materials.
  - 1. Prepare surface by brushing, scrubbing, scraping, or grinding to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion and integrity of the foam insulation system. Wipe down metal surfaces to remove release agents or other no compatible coatings, using clean sponges or rags soaked in a solvent compatible with the foam insulation. Ensure surfaces are dry before proceeding.

#### **3.3 APPLICATION – SPRAY FOAM**

- A. Apply foam insulation in strict accordance with ULC S705.2, manufacturer's written instructions, and the following.
  - 1. Apply foam insulation only when surfaces and ambient temperature are within limits prescribed by the material manufacturer.
- B. Fill joints with foam sealant making allowances for post expansion of foam.
- C. Finish joints shall be free from air pockets and imbedded foreign materials. Cut back excess foam sealant after cutting flush with surrounding surfaces unless otherwise directed and/or detailed.
- D. Apply foam insulation to within the following tolerances: minus 1/4 inch thickness or plus 1/2 inch thickness indicated on the Drawings.
  - 1. Trim, as required, any excess thickness that would interfere with the application of cladding/covering system by other trades.
- E. Finished sprayed foam insulation shall be free of voids and imbedded foreign materials.

- F. Do not install spray polyurethane foam within 3 inches of heat emitting devices such as light fixtures and chimneys.
- G. Complete connections to other components and repair any gaps, holes or other damage using material which conforms to ULC S710.1 or ULC S711.1 and installed in accordance with ULC S710.2 or ULC S711.2 as applicable.
- H. Do not allow foam insulation to cover or mark adjacent surfaces. Use masking materials if necessary.
- I. Do not permit adjacent work to damage work of this section. Damage to work of this section caused by other sections shall be made good by this section at the expense of the section which caused the damage.

#### 3.4 INTERFACE WITH OTHER WORK

- A. Coordinate the work of this Section installation of windows and door frames. Ensure air and vapor barrier transitions from windows and door frames is completed.

#### 3.5 FIELD QUALITY CONTROL

- A. Field inspection will be performed under the provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Non-Conforming Work: Remove and replace all non-conforming work.

#### 3.6 CLEANING

- A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of sprayed-foam and other materials installed under this Section.
- B. Clean work under provisions of Section 01 70 00 – EXECUTION.
  - 1. Remove over-spray and masking materials immediately after foam has cured to hard surface film.
  - 2. Clean and make good surfaces soiled or damaged by work of this section. Consult with section of work soiled before cleaning to ensure methods used will not damage the work.
- C. Waste Management:
  - 1. Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
  - 2. Dispose of liquid waste in accordance with all applicable regulations. Consult all regulations (federal, provincial, state, local) or a qualified waste disposal firm when characterizing waste for disposal. Contact manufacturer for MSDS sheets for product information, and recommendations for proposal disposal. Utilize licensed waste disposal companies as may be required, the following phone numbers for national companies are provided for the Contractor's convenience only.
    - a. Safety Kleen, Plano TX., (telephone 800-669-5740).

- b. Clean Harbors, Norwell MA., (telephone 800-422-8998).
- c. Phillip Services Corporation (PSC), Houston TX., (telephone 800-726-1300).

3.7 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- B. Protect spray foam insulation from ultraviolet light following installation on exterior surfaces, do not leave exposed to weather elements for a period greater than 30 calendar days.

End of Section

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Section 07 26 00  
VAPOR RETARDERS

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Vapor barriers and in walls, floor assemblies and roof assemblies.
  - 2. Self adhering vapor barrier at dormered spaces.
  - 3. Foamed-in-place insulation / air barrier sealant: applied to seal gaps, cracks, cavities and joints in the building envelope, at door frames, perimeter of window frames, and other similar penetrations in exterior walls.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing partitions, walls and related insulation.
- D. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete slabs on grade.
- E. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, nailers.
- F. Section 07 21 00 - THERMAL INSULATION: Thermal insulation.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM D 570 - Water Absorption of Plastics.
  - 2. ASTM D 1004 - Initial Tear Resistance of Plastic Film and Sheeting.
  - 3. ASTM D 1622 - Apparent Density of Rigid Cellular Plastics.
  - 4. ASTM D 1938 - Tear Propagation Resistance of Plastic Film and Thin Sheeting by a Single-Tear Method.

5. ASTM D 2842 - Water Absorption of Rigid Cellular Plastics.
6. ASTM D 2582 - Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.
7. ASTM D 2856 - Open Cell Content of rigid Cellular Plastics by Air Pycnometer.
8. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C.
9. ASTM E 84 - Surface Burning Characteristics of Building Materials.
10. ASTM E 96 - Water Vapor Transmission of Materials.

B. General References The following reference materials are hereby made a part of this Section by reference thereto:

1. NFPA 701 - Fire Tests for Flame Resistant Textiles and Films
2. All applicable federal, state and municipal codes, laws and regulations for thermal insulation and vapor barriers.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing: Coordinate work of this section with related work.

#### 1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
2. Manufacturer's Instructions: Manufacturer's installation instructions for placement, seaming and pipe boot installation.

#### 1.7 QUALITY ASSURANCE

A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

B. Sole Source: Obtain products required for the Work of this Section for each type of vapor retarder shall be from a single manufacturer, and the related accessories as recommended by the prime manufacturer of the vapor retarder.

#### 1.8 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.



- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  2. Store materials under cover and in manner to keep them dry, protected from weather, direct sunlight and damage from construction traffic and other causes.

## PART 2 - PRODUCTS

### 2.1 VAPOR BARRIERS WITHIN BUILDING ASSEMBLIES

- A. Smart vapor barrier: Class A vapor-variable SVB type membrane,
1. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on 475 High Performance Building Supply, Brookline NY., product: "Intello Plus".
  2. Acceptable products are limited to the following:
    - a. 475 High Performance Building Supply, Brookline NY., product: "Intello Plus".
    - b. SIGA, Chicago, IL., product "Majrex 200."
    - c. Partel Inc., New York, NY, product "Vara Plus".
- B. Membrane vapor barrier: Flexible self-sealing, self-healing, fully adhering composite flexible membrane consisting of .8 mm (32 mils) of self adhesive rubberized asphalt integrally bonded to .2 mm (8 mils) of cross-laminated, high-density polyethylene film to provide a min. 1 mm (40 mil) thick membrane. Membrane shall be interleaved with silicone-coated release paper until installed. Provide with manufacturer recommended surface conditioners and termination mastics.
1. Acceptable Products include:
    - a. Grace Construction Products, product: "Perm-A-Barrier Wall Flashing".
    - b. Carlisle Waterproofing, product: "CCW-705".
    - c. W.R. Meadows, product: "Air-Shield Thru-Wall Flashing".
  2. Minimum performance characteristics.
    - a. Water Vapor Transmission: ASTM E 96, Method B – 0.05 perms maximum
    - b. Water Absorption: ASTM D 570 – Max. 0.1% by weight
    - c. Puncture Resistance: ASTM E 154 – 40 lbs.
    - d. Tear Resistance:
      - 1) Initiation – ASTM D 1004 – minimum 58 N (13.0 lbs.) M.D.
      - 2) Propagation – ASTM D 1938 – minimum 40 N (9.0 lbs.) M.D.
    - e. Lap Adhesion at -4°C (25°F): ASTM 1876 – 880 N/M (5.0 lbs./in.) of width
    - f. Low Temperature Flexibility – ASTM D 1970 – Unaffected to -43°C (-45° F)
    - g. Tensile Strength: ASTM D 412, Die C Modified – Minimum 5.5 MPa (800 psi)

- h. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D 412, Die C – Min. 200%
3. Surface primer: Latex based, water dispersed liquid for substrate as recommended by membrane manufacturer.
4. Termination mastic: Rubberized asphalt-based mastic with 200 grams/liter max VOC content for use in sealing flashing membrane terminations and punctures, as recommended by wall flashing manufacturer.

## 2.2 FOAMED-IN-PLACE INSULATION

- A. Foamed-in-place insulation for air barrier sealant: UL Class I, two component polyurethane self frothing foam insulation equal to Dow Chemical Corporation, product “Froth-Pak” having the following characteristics:
  1. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
    - a. BASF Corp., Polymers Div., Styropar Group, Parsippany NJ.
    - b. Dow Chemical Corporation (Dow Building Solutions), Midland MI.
    - c. Universal Protective Coatings, San Rafael CA.
  2. Product characteristics.
    - a. Propellant: HCFC or HFC, No CFC's are permitted.
    - b. Apparent Density (ASTM D1622): 1.7 pounds per cubic foot. (with 1.75 pcf HCFC)
    - c. Water Absorption (ASTM D2842): less than 2.5 percent water absorbed.
    - d. Open cell content (ASTM D2856): less than 2 percent.
    - e. Apparent aged (18 months) R value: 4.9 per inch.
    - f. Flexural Strength, parallel (ASTM C203): 17 to 23 pounds per square inch.
    - g. Flexural Strength, perpendicular (ASTM C203): 26 to 42 pounds per square inch.
    - h. Flame Spread (ASTM E84): 25 or less (Class 1 rated).
    - i. Smoke Developed (ASTM E84): 350 (Class 1 rated), tested for 2 inch depth.

## 2.3 ACCESSORIES

- A. General: Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each type of vapor barrier.
  1. Double-stick tape for attachment of vapor barrier: Double coated acrylic closed-cell foam tape, as manufactured by 3M Industrial Specialties Division, St. Paul MN, , product “Scotch VHB - 4952” or approved equal, having a thickness of 0.045 inches and a width of 1 inch.
- B. Air seal boot: PVC or EDPM premolded pipe and seal for penetrations at ceiling vapor barrier.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Ensure that subsoil is approved by Architect.
- B. Level and tamp or roll aggregate, sand or tamped earth base.

#### **3.2 INSTALLATION - VAPOR BARRIERS WITHIN BUILDING ASSEMBLIES**

- A. Place vapor and air barrier on warm side of all thermal insulation. Attach using commercial grade double stick tape. Lap and seal all sheet joints.
- B. Extend vapor and air barrier tight to full perimeter of adjacent window and door frames and other items interrupting the plane of membrane. Tape seal in place.

#### **3.3 INSTALLATION - FOAMED-IN-PLACE AIR BARRIER**

- A. Foamed-in-place air barrier: Apply foam in froth method to a uniform monolithic density without voids, in accordance with manufacturer's instructions.
  - 1. Apply application of foam for air barrier seal includes, but is not limited to:
    - a. Door frames, window frames, and similar penetrations in exterior walls.
    - b. Gaps, cracks, cavities and joints in the building envelope, not sealed with other forms of air boots, including electrical boxes and conduit, ducts, fans, and piping.
    - c. Where additionally indicated on Drawings.

End of Section

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Section 07 31 26  
SLATE SHINGLE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Description of existing assemblies: Slate shingle roofing systems indicated to remain and to be selectively restored are present at the exterior pitched roof surfaces of the building, as indicated on drawings and further described below.
1. Existing roofing system consists of graduated slate shingles nailed to a gypsum-panel roof deck on ferrous metal framing, with felt underlayment and sheet metal flashing at eaves, valleys, ridges, penetrations and other transitions, and slate shingle cladding at vertical walls of dormers.
    - a. Existing slate material: Vermont; purple, green and pink.
    - b. Shingle dimensions vary significantly because of graduated sizes, and include existing units up to thirty inches in length.
  2. Existing conditions to be addressed in the work include broken or missing shingles.
- B. Scope of Work:
1. Field-verification of conditions and dimensions of existing late shingle roofing assemblies.
  2. Protection of existing slate shingle roofing assemblies indicated to remain without repair or replacement.
  3. Selective removal and re-installation of slate shingles, to allow performance of flashing and other work adjacent to or beneath slate roofing assemblies and as indicated on the drawings.
  4. Replacement of existing slate shingles, in addition to work indicated on the drawings, with salvaged or new shingles. It is the intent of the project to use salvaged shingles to the greatest extent possible. New slate, subject to product requirements of this Section, will be considered when salvage materials are exhausted. Area of this replacement work shall be equal to five percent (5%) of the total area of shingle roofing work in this Section.
  5. Coordination of slate shingle roofing work with metal flashing and trim.
  6. Replacement of wood nailing strips at starter course at eave.
  7. Repairs to existing gypsum roof deck, to fill openings, penetrations or damage discovered upon removal of existing roofing, as follows below.
    - a. Any modifications to the gypsum roof deck resulting in damage less than or equal to 144 sq in shall be repaired using gypsum plaster.
    - b. Any modifications to the gypsum roof deck larger than 144 sq in shall be repaired with 3/4" pressure-treated plywood sheathing.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
1. Requirements related to hazardous building materials including but not limited to asbestos are indicated in Division 02 Section ASBESTOS ABATEMENT.
  2. Work at stone masonry is indicated in Division 4 Section, STONE MASONRY RESTORATION.

3. Selective repair of existing wood elements adjacent to slate roofing is indicated in Division 6 Section, EXTERIOR FINISH CARPENTRY.
4. Sheet metal flashing and trim adjacent to slate roofing is indicated in Division 7 Section, SHEET METAL FLASHING AND TRIM.

## 1.2 SUBMITTALS

- A. Product Data: For each type of roofing product specified. Include data substantiating that materials comply with requirements. Submit an affidavit from the quarry supplying the slate stating the source of the slate.
- B. Certification of specification compliance of all materials.
- C. Samples for Verification: Of the following products:
  1. Slate shingle samples, full size, for review and approval by Architect. Samples shall show typical range of color, texture and thickness.
  2. Snow rail and snow guard, full size.
- D. Manufacturers Material Safety Data Sheet (MSDS) must be submitted for each manufactured product.
- E. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of the roofing system with requirements based on comprehensive testing current product compositions.
  1. Preconstruction Quarry Slate Tests: The Contractor shall submit test results from quarry to conform with ASTM C406 to meet specified grade, thickness and quality.
  2. Preconstruction On-Site Slate Tests: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by the Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
    - a. Field testing on slate delivered from the quarry to confirm compliance with ASTM C406-89. Test results shall be delivered to the Architect for final approval of the slate prior to installation of slate.
- F. Submit the following under provisions of Section 01 33 00 - Submittal Procedures:
  1. LEED Submittal Requirements:
    - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
      - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
        - a) a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
        - b) b) EPD shall have at least Cradle to Gate scope,
      - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
    - b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
      - 3) Recycled Content:

- a) a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
- b) b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
- 4) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
  - a) a) Documentation should be in the form of one of the following:
    - b) b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
    - c) c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
    - d) d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
    - e) e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
    - f) f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
- 5) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an HPD.

### 1.3 QUALITY ASSURANCE

- A. Comply with requirements of NRCA (National Roofing Contractors' Association) technical publications as indicated.
- B. Application of roofing systems shall be coordinated with installation of metal and fabric flashings and all other similar items to provide a watertight installation.
- C. Requirements given herein may be affected by other related requirements of the project specification. Correlation of contract requirements is the responsibility of the Contractor.
- D. Installer's minimum qualifications shall be as follows:
  - 1. Historic Building Slate Roof Specialist: Work must be performed by a firm having not less than five (5) years successful experience in slate roof installation on at least three (3) buildings listed in the National Register of Historic Places (or comparably designated at the city or town level) in the last five (5) years, and employing personnel skilled in the work indicated. Furnish names of Owners and Architect/Engineer of two buildings on which Applicator has installed satisfactory roof similar to type specified herein.
  - 2. Installer Qualifications: Company experienced in installing natural slate roofing of the type and scope specified in this section and employing persons with not fewer

than five years of documented experience. Company shall provide skilled workers, thoroughly trained and experienced in the necessary crafts of natural slate roof systems and who are familiar with this specification and methods required for a warrantable roof.

- E. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.
  - 2. Install in area and of size designated by Architect. Provide (2) mock-ups, (36) square feet each, incorporating varying flashing conditions.
  - 3. Do not proceed with remaining work until finish color, texture, pattern, joint sizes, and installation workmanship are approved by Architect.
  - 4. Correct mock-up area as required to produce acceptable work.
  - 5. Mock-up may be incorporated into final construction upon Architect's approval.
- F. Do not apply self-adhering membrane, roofing felt or shingles when substrate is wet.
- G. FM Global Standards: Provide installation and products in conformance with standards of Factory Mutual Insurance Company (FM Global) applicable, at the location of the Project, to work indicated in this Section.
- H. Owner's Insurer Approval: Submit to the Owner, via the Architect, any product data, installation drawings and other documents as the Owner may require to obtain approval of the Owner's insurer of installation of work indicated in this Section, before proceeding with the work.

#### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store shingles on edge supported at quarter points on two level runners of wood 2 inches wide.
- B. Lean shingles against each other at slight angle from vertical with first shingle of each row leaning against solid support.
- C. Separate stacked rows with runners as required for bottom row.
- D. Stack shingles not more than four tiers high.
- E. Keep stored shingles free from rain, snow and ice.

#### 1.5 SPECIAL GUARANTEE / WARRANTY TERMS

- A. Slate Shingle Distributors Warranty: Submit slate shingle distributors warranty, signed by the distributor and covering the slate shingles described in this section, in which the distributor agrees to replace slate shingles that fail in materials. The duration of this warranty shall be established by ASTM C406 and grade indicated in this specification.



- B. Roofing Installer's Warranty: Submit roofing installer's warranty, signed by roofing Installer and covering Work of this Section, in which roofing Installer agrees to repair or replace slate roofing that fails in materials or workmanship within the following warranty period:
  - 1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 LEED REQUIREMENTS

- A. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
  - 1. Provide products with Third Party Environmental Product Declaration (EPD) whenever possible.
- B. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
  - 1. Provide products with publicly available material inventories whenever available.

### 2.2 SLATE SHINGLES, GENERAL

- A. Work of this Section requires the use of existing slate shingles salvaged from the current roofing installation at the building (preferred) and new slate shingles (when the supply of existing shingles is exhausted).

### 2.3 DISTRIBUTORS FOR NEW SLATE SHINGLES

- A. Subject to compliance with requirements, provide slate as furnished by one of the following:
  - 1. Evergreen Slate Co., 68 East Potter Avenue, P.O. Box 248, Granville, NY, 12832. Tel: (518) 642-2530.
  - 2. Vermont Structural Slate Company, Inc., Box 98, 3 Prospect Street, Fair Haven, VT 05743. Tel: (802) 265-4933 or (800) 343-1900.
  - 3. The New England Slate Company, 1385 US Route 7, Pittsford, VT 05763; Tel: (802) 247-8809 or toll free (888) NE-SLATE.
  - 4. North Country Slate. 8800 Sheppard Avenue East; Toronto, Ontario, Canada, M1B 5R4; toll free (800) 975-2835.
- B. Substitutions: Subject to compliance with requirements. Certificate of origin required.

### 2.4 NEW SLATE SHINGLES

- A. Slate Shingles: Hard, dense, sound rock, punched or drilled for two nails each. Slate shingles shall be punched or drilled back to front and on the thinner end when there is variation in thickness along the length of the shingle.

- B. No slate shingles with broken corners shall be installed when either the base or leg of the right triangle piece broken off is greater than 1-1/2 inches (38 mm). No broken corners on covered ends which sacrifice nailing strength or laying a watertight roof. Broken corners are acceptable for cutting stock. Not more than 2 percent of broken slates, including those having cracks materially precluding ringing when sounded, shall be accepted.
- C. Slate shall be free of any visible inclusions of oxidizable iron pyrite.
- D. Curvature or twist in slate shingles shall not exceed 1/8 inch in 12 inches (3 mm in 100 mm). Curved slate shingles shall be trimmed and punched to permit them to be laid with convex side up. Knots, knurls and cramps are acceptable on the exposed slate shingle face. Knots, knurls and cramps on the back or covered portion of slate shingles, which could prevent close contact of slate shingles or the laying of a watertight roof, will not be accepted.
- E. Dimensions and Properties:
  - 1. Source: Provide all slate shingles from a single distributor and a single quarry source.
  - 2. Match appearance, color and texture and dimension range of existing slate shingles.
  - 3. Grade: ASTM C 406 Grade S1: Expected service life in excess of 75 years.
  - 4. Dimensions: Variable, because of existing graduated slate.
  - 5. Color: Royal purple, unfading green, and semi-weathering green.
  - 6. Surface: Natural Cleft.
  - 7. Edges: Trimmed, to match edge of existing shingles.

## 2.5 UNDERLAYMENT

- A. Coated Felt Underlayment: ASTM D 2626, asphalt-saturated and coated organic felt, mineral surfaced, unperforated, No. 40, 30 pound, coated two sides.
- B. Self-adhered membrane underlayment: Products by W.R. Grace, Cambridge, MA, are referenced below; equivalent products by Bakor, Henry Company, El Segundo, CA; CertainTeed, Valley Forge, PA; or an approved equal may be submitted. Self-adhered membrane underlayment and all accessories, including liquid membrane and primer, must be from the same manufacturer
  - 1. Self-adhered membrane underlayment: 0.040 in. thick self-adhering rubberized-asphalt membrane with integrally bonded polyethylene laminate; top surface is to be smooth, not granulated: Ice & Water Shield as manufactured by W.R. Grace.
  - 2. Liquid membrane: Bituthene Liquid Membrane.
  - 3. Primer: Perm-A-Barrier WB Primer.
- C. Paper Slip Sheet: 5-lb/square red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.

2.6 ACCESSORIES AND MISCELLANEOUS MATERIALS

- A. Slating Nails for Roof Deck: Slater's copper ring shank nails, 0.120 inch (3 mm) or No. 11 gauge Stubs, not less than twice the nominal slate thickness plus 1 inch (254 mm) in length, with 3/8 inch (9 mm) head. Point shall penetrate through underside of deck except where the underside of roof deck is exposed to view, where shorter nails are acceptable. Nails 1/2 inch (13 mm) or longer than field slate nails for slate hip and ridge installation.
- B. Wood Nailers and Cant Strips: Preservative-treated wood.
- C. Felt Underlayment Nails: Aluminum, stainless-steel, or copper wire nails with low-profile capped heads or disc caps, 1 inch (25 mm) minimum diameter driven through tin buttons.
- D. Cements and Mastic: Mortar cement and mastic consisting of asphaltic non-running heavy body plastic cement composed of glass, polyester or polypropylene fibers, asphalt and other ingredients.
- E. Sealants: Type II - reference Division 7 Section "Joint Sealants".
- F. Material for infill of openings and penetrations in gypsum deck roof:
  - 1. Gypsum Plaster: Structo-Lite Basecoat Plaster, manufactured by USG or approved equal.
  - 2. Metal lath: As recommended by gypsum plaster manufacturer.
- G. Accessories for Slate Shingle Wall Cladding:
  - 1. Slip sheet: Rosin sized building paper.
  - 2. Z-Clip girts: 3-1/2 inch deep z-shape hot-dipped galvanized to G90 coating, designed to accommodate expansion and contraction, dynamic movements and design load requirements; provide plastic shims as thermal separator between applied copper, and sub-girts
  - 3. Fasteners Copper: of sizes most appropriate for the specific application, and equipped with soft neoprene washers.
  - 4. Insulation: 3-1/2 inch mineral wool as specified under Section 07 21 00.
  - 5. Sealant in conjunction with metal work: Sealant Type "SE" and backer materials as specified under Section 07 92 00 - JOINT SEALANTS.
  - 6. Solder: Conforming to ASTM B 32 with non-acid flux.
    - a. For use with plain copper sheet: Solder: 50 percent tin / 50 percent lead solder.
  - 7. Flux: FS O-F-506.
  - 8. Primer for protection membrane: As recommended by membrane manufacturer.
  - 9. Clips for flashing and counter flashing: 20 oz cold-rolled soft-temper sheet copper conforming to ASTM B 101, Type 1, Class A. coated at a rate of 7-1/2 pounds per side per 100 square feet.

- H. Snowguards: PP503 Three-Pipe Height Adjustable Snow Guard, manufactured by Alpine Snowguards.
  - 1. Brass with brass base plate.
  - 2. Mill finish.
- I. Plywood Sheathing: Refer to Division 06 Section "Rough Carpentry".

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine all surfaces and contiguous elements to receive work of this section and correct, as part of the Work of this Contract, any defects affecting installation, including but not limited to selective replacement of wood roof deck.
- B. Commencement of work will be construed as complete acceptability of surfaces and contiguous elements.
- C. Do not apply materials over wet substrates.
- D. Do not proceed with installation of slate shingles until substrate defects are corrected.

#### 3.2 GYPSUM PLASTER APPLICATION

- A. At openings or penetrations large enough to require additional support for new plaster, following manufacturer's recommendations, install metal lath. Fasten lath to surrounding gypsum deck and to any deck supports at the opening.
- B. Apply the basecoat plaster by hand or machine in one or two coats.
- C. Apply the plaster basecoat (first coat) with sufficient material and pressure to form a good bond to the base and to cover well; then double back to bring the plaster to alignment with the surrounding roof deck surface. Straighten to a true surface with a rod and darby without the use of additional water and leave rough to receive the finish (second) coat.

#### 3.3 UNDERLAYMENT AND FLASHING INSTALLATION

- A. Install self-adhering rubberized asphalt membrane at locations as indicated on drawings.
- B. Install coated felt underlayment at all slate shingle roofing areas where roof deck is not covered by rubberized membrane.
- C. Install rosin paper slip sheet between all rubberized membrane and sheet metal.
- D. Coordinate installation of slate roofing with installation of all sheet metal flashing and trim and with installation of other roofing systems.

3.4 SLATE ROOF INSTALLATION

- A. Install new slate at locations as indicated on drawings.
- B. Install new as per NRCA Steep Roofing Manual.

3.5 PROTECTION

- A. Protect existing construction, adjacent work and finished work from damage.
- B. Damage caused by the handling, storing, mixing or application of materials or the failure to provide adequate protection shall be repaired or replaced at no additional cost to the Owner.

3.6 ACCEPTANCE

- A. On completion of work all equipment and rubbish resulting from the work of this section shall be removed from the premises.
- B. Leave work clean, whole, and sound ready for additional finish or sealing as specified and/or as shown on the drawings.

End of Section

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Section 07 54 23

THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install Factory Mutual (FM) approved fully adhered Energy Star compliant thermoplastic polyolefin (TPO) roofing system at Canopies, where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Roofing system includes, but is not limited to the following:
  - 1. Pressure preservative treated solid wood and plywood blocking required for the work of this Section 07 54 23.
  - 2. Roofing membrane and related system components.
  - 3. Roof edge covers.
- B. Provide manufacturer's pre-construction and final inspection as specified herein. These inspections are to be included in the base bid; additional inspections, or work incurred as a result of the final inspection shall be without additional cost to the Owner.
  - 1. Work of this section includes Contractor's completion of FM form 2688 - *Contractor's Application for Acceptance of Roof* and submittal to FM Global. (FM Form 2688 is bound in the Project Manual after this Section 07 54 23)
  - 2. Work of this Section additional includes providing Owner assistance in the preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended insurance coverage of roofing and associated work.
- C. Walkway Protection: Install walkways at locations shown, and where required leading from roof access points (ladders, stairs, doorways) to, and around rooftop mechanical equipment.
- D. Provide testing of heat-welded seams.

1.3 RELATED REQUIREMENTS

- A. Section 05 30 00 – METAL DECKING: Metal deck substrate.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.

Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ASTM D6878 – Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.
  2. ASTM E108 - Fire Test of Roof Coverings.
  3. FM Roof Assembly classifications and loss prevention requirements contained in FM Global Property Loss Prevention Data Sheets 1-28, 1-29, and 1-31.
  4. UL Fire Resistance Directory.
  5. All applicable federal, state and municipal codes, laws and regulations for fire-resistance roof ratings.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. American Society of Civil Engineers, ASCE-7 - Minimum Design Loads for Buildings and Other Structures.
  2. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): Architectural Sheet Metal Manual.
  3. NRCA - Roofing and Waterproofing Manual, Latest edition.
  4. Roof System Manufacturer's published Technical Specifications, Bulletins and Advisories.
- C. Definitions:
1. Roofing Terminology: Refer to ASTM D1079 and the glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

## 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
1. Required attendees: Owner, Architect, Contractor, Roofing Applicator's Project Superintendent, roof manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
    - a. Section 05 30 00 - METAL DECKING.
    - b. Section 07 62 00 - SHEET METAL FLASHING AND TRIM.
  2. Agenda:
    - a. Scheduling of roofing operations.



- b. Review of shop submittal requirements.
  - c. Review of staging and material storage locations.
  - d. Coordination of work by other trades.
    - 1) Coordination of details with air and vapor barrier system.
  - e. Installation procedures for mechanical equipment.
  - f. Protection of partial completed assemblies.
  - g. Protection of completed roofing.
  - h. Establish weather and working temperature conditions to which Architect and Contractor must agree.
  - i. Emergency foul weather and rain protection procedures.
  - j. Establish conditions for which a temporary roof will be provided by the Contractor.
  - k. Discuss process for manufacturer's inspection and acceptance of completed roofing and flashings.
  - l. Manufacturer's deck inspection to be performed.
  - m. Field quality control and close-out testing procedures.
- C. Scheduling:
- 1. Notify manufacturer's representative 48 hours in advance for deck acceptance. Plan the lay-up of roofing membrane with respect to deck slope; avoid situations where excessive drainage could pass into completed roofing.
  - 2. The Roofing applicator shall maintain communication with roofing manufacturer's representative to inform of progress and to schedule period sample testing.

## 1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
- 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished under this Section.
    - a. Include for roofing and insulation products: chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.
    - b. Include certification of data indicating Volatile Organic Compound (VOC) content of all components of roofing system.
  - 2. Manufacturer's specimen warranties: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
  - 3. Certification:
    - a. Manufacturer's certification stating that roofing materials comply with specified ASTM and referenced trade standards.
    - b. Manufacturer's written certification stating that roofing and insulation products and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section and that all FM and

- Underwriters Laboratories (UL) fire-resistive requirements for the indicated Labels have been met.
- c. Submit roof manufacturer's certification that insulation fasteners and insulation furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.
  - d. Roof manufacturer's certification that roof system is approved by Factory Mutual (FM), Underwriters Laboratories (UL), Warnock Hersey (WH) or approved third party testing facility in accordance with ASTM E108, Class 1A for external fire and meets local or nationally recognized building codes.
4. Review statement: Written statement, signed by the roofing applicator, stating that the Contract Drawings have been reviewed by an agent of the roofing system manufacturer; accompanied by a pre-installation written statement from the manufacturer that the selected roof system is proper, compatible, and adequate for the application shown.
    - a. The roofing applicator will notify the Architect and Owner in writing if the existing conditions when exposed are in conflict with the Contract Documents for the proper application of the selected roofing system or the warranty requirements.
  5. Project roofing superintendent's resume and project experience list for similar installations.
  6. Shop drawings:
    - a. Fully dimensioned 1/4-inch scale plans of roof. Plans shall show changes in level, key locations of details, all roof penetrations, roof slopes and direction of slope. Indicate on plans any areas of proposed staging and material storage on roof.
      - 1) Include, setting plans for tapered insulation showing types of insulation, thickness and direction of slopes.
      - 2) Identify installation phasing and sequence.
    - b. Large scale design details, minimum of 1-1/2 inch per foot scale, showing perimeter flashing conditions and penetrations. Details shall show dimensions of actual measurements taken at the project and reflect actual conditions; manufacturer's standard preprinted details will not be accepted as substitute for shop drawings.
  7. Verification samples:
    - a. Furnish samples as requested by the Architect.
    - b. Provide 8-1/2 by 11 inch samples of roofing membrane and membrane flashing materials.
    - c. Provide 12 inch long samples of membrane batten.
    - d. Provide 12 inch long samples of each metal flashing type.
    - e. Furnish additional samples are requested by the Architect.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Manufacturer's field quality control reports of field inspections, including, revised "as-built" shop drawings and manufacturer's final punch list.

2. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

#### 1.7 QUALITY ASSURANCE

- A. Single source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of roofing system membrane.
  1. All roofing materials shall be provided and approved by the roof system manufacturer. Any materials not manufactured or provided by manufacturer shall have written approval from the manufacturer stating the materials are acceptable and are compatible with the other materials and systems required.
- B. Installer authorization: Roofing subcontractor/installer shall be acceptable and licensed by the roof membrane manufacturer.
- C. Fire performance characteristics: Provide a Factory Mutual Class 1 fire resistance rating or Listed by Underwriter's Laboratories or Warnock Hersey for external fire tests of ASTM - E-108 Class A.
  1. Maintain clean and easily accessible copy of this specification on-site at all times during roofing work.
  2. Provide labeled materials for all components of the roofing system, which have been tested and listed by UL in "Building Materials Directory" for application indicated, with "Class A" rated materials/system for roof slopes indicated.
  3. Insulation: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Roof Manufacturer's Specifications: The roof system manufacturer's Technical Specifications shall be considered a part of this specification and should be used as a reference for specific application procedures and recommendations. Where a conflict does exist between the manufacturer's written specifications and those procedures specified in this Section, the more stringent requirements meeting the Manufacturer's minimum requirements for the provided warranty shall apply.
  1. Roofing Subcontractor shall provide at no additional cost to this contract, all additional labor and materials to conform to manufacturer's required installation procedures which are necessary to provide a total roofing system which is in full compliance with manufacturer's warranty requirements, including additional materials, installation procedures, manufacturer's inspections, sample testing and other requirements.
  2. Maintain clean and easily accessible copy of the roof system manufacturer's Technical Specifications on-site at all times during roofing work.
- E. Manufacturer's Inspections:
  1. Manufacturer's On-site Inspections: Make arrangements to have manufacturer's representative (employed by manufacturer) be present on-site during the Work of this Section at key points, which include, but are not limited to:

- a. Roofing pre-installation meeting.
  - b. Manufacturer shall visit and inspect roofing work not less than 4 times (excluding final inspection) during the progress of work.
  - c. Inspection of installation prior to flood testing.
2. When roofing work is in progress, the roofing system manufacturer will provide a authorized representative who shall perform the following, at no additional cost to the Owner:
- a. Keep the Architect informed as to the progress and quality of the work as observed.
  - b. Provide job site inspections during the performance of roofing work. Manufacturer shall visit and inspect roofing work not less than 4 times (excluding final inspection) during the progress of work.
  - c. Report to the Architect in writing any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.
  - d. Confirm after completion, that the manufacturer's representative has observed no application procedures which were in conflict with the Contract Document Specifications and manufacturer's own technical specifications, other than those that may have been previously reported and corrected.
3. The manufacturer's authorized representative shall provide a final inspection at the completion of the project to insure, that the project has been completed in accordance with the manufacturer's requirements and those of this specification. Upon approval and acceptance of the project, then a manufacturer's warranty certification shall be written, executed and furnished to the Owner.
- a. Submit Manufacturer's field quality control reports of field inspections, including, revised "as-built" shop drawings and manufacturer's final punch list.

#### 1.8 QUALIFICATIONS

- A. Roofing Subcontractor/installer: Minimum of 5 years documented experience demonstrating previously successful work of the type specified herein, and certified by the roofing system manufacturer as trained and qualified to install the specified manufacturer's roofing materials.
- B. Roofing Subcontractor/installer's supervisor/foreman: minimum of 5 years documented experience of the type specified herein, and trained by product manufacturer.
  1. Installer to maintain a full-time supervisor/foreman on the job site for all phases of roofing work and at all times when roofing work is in progress.

#### 1.9 REGULATORY REQUIREMENTS

- A. Roofing system, including insulation and substrate, shall meet Underwriters Laboratories, Inc. Fire Hazard Classification "Class 1" roof.
- B. Refer to applicable building codes for roofing system installation requirements and limitations. When a conflict exists, the more restrictive document will govern.

#### 1.10 DELIVERY, STORAGE AND HANDLING

- A. Delivery of materials:
  - 1. Deliver materials in manufacturer's original, unopened containers or packages with labels and package seals intact and legible.
  - 2. Deliver materials in sufficient quantity to allow continuity of work.
  - 3. Coordinate delivery with General Contractor.
  - 4. Do not order project materials or start work before receiving Architect's approval.
  
- B. Store all materials in accordance with the manufacturer's recommendations and in accordance with material safety data sheets (MSDS).
  - 1. Store rolled goods on clean, raised platforms.
  - 2. Store insulation on dunnage and completely cover with a water-resistant breathable material. Provide weights to prevent wind damage to insulation.
  - 3. Store other materials in dry areas, protected from water and direct sunlight.
  - 4. Do not expose stored curable roofing materials and accessories, including uncured flashing, adhesives, sealant and pourable sealer, to a constant temperature in excess of 80 degrees Fahrenheit.
  
- C. Protect stored materials: Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes. Provide continuous protection of stored materials for duration of project.
  
- D. Distribute any materials stored on roof levels for immediate use to prevent concentrated loads that would impose excessive strain on deck or structural members. Protect roof stored materials to prevent displacement by the wind and protect from exposure to inclement weather and sun.
  
- E. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.
  - 1. Remove from project all insulation which is wet, warped or broken.

#### 1.11 ENVIRONMENTAL REQUIREMENTS

- A. Apply roofing in dry weather; do not install roofing in inclement weather or when precipitation is predicted with greater than 20 percent possibility.
  
- B. Do not apply roofing membrane to damp or frozen deck surface.
  
- C. Apply roofing when ambient temperature is above 40 degrees Fahrenheit.

#### 1.12 WARRANTY

- A. Deliver to the Owner upon completion of the work of this Section, an unconditional warranty, on the work of this Section agreeing to promptly repair the roofing as necessary to prevent penetration of water through it.

1. Warranty shall cover product quality, performance, and workmanship for a period of **20** years.
2. Warranty shall cover total roofing system including membrane, insulation, adhesives, sealant, fasteners, membrane flashings, edging and coping materials, roofing-related metal flashings, and other materials provided under this Section 07 54 23 and Section 07 71 00.
3. Warranty shall provide coverage for uplift created by a wind speed of 72 miles per hour.
4. Warranty shall include provision for reflectance, guaranteeing compliance with Energy start reflectivity guidelines for aged membrane for a period of not less than 10 years.
5. Pro-rated system warranties shall not be accepted.
6. Evidence of the manufacturer's warranty reserve shall be included as part of the project submittals for the Owner's approval

## **PART 2 - PRODUCTS**

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products are limited to the following:
  1. Carlisle Syntec, Carlisle PA.
  2. Firestone Building Products Co., LLC, Indianapolis, IN.
  3. Johns Manville Roofing Systems, Denver, CO.

### 2.2 SYSTEM DESCRIPTION

- A. Fully adhered heat weldable TPO membrane roofing system, including insulation and substrate, shall meet Underwriters Laboratories, Inc. Fire Hazard Classification "Class A" roof.
- B. Factory Mutual Requirements
  1. FM RoofNav Assembly: Comply with requirements of FM RoofNav Assembly Number 00000 and as additionally specified herein for *Factory Mutual System Approval Guide* Class I rated roof.
  2. FM listing: Provide TPO sheet roofing system and component materials that have been evaluated by Factory Mutual System for fire, wind up lift and hail damage and that are listed in *Factory Mutual System Approval Guide* for Class I construction.
  3. Wind Uplift Rating: Membrane roofing system shall be secured to decking in accordance with requirements of FM 1-28 for Roof System Approval Rating of FM I-150, based on a Basic Wind Speed of **120** miles per hour.
  4. Above-deck roof components shall be designed and installed in accordance with requirements of FM 1-29 for performance requirements specified above.
  5. Provide roof-covering materials that bear FM approval markings on the packaging.
  6. Indicate that materials have been subjected to FM's examination and follow-up inspection services.

### 2.3 ROOFING MATERIALS

- A. Roofing membrane: Thermoplastic Polyolefin based, scrim-reinforced membrane complying with ASTM D6878, having a nominal thickness of 60 mils (1.5mm). Exposed top surface of roof membrane over scrim shall be a thickness not less than 30 percent of total membrane thickness.
  - 1. Color: white, off-white or light-gray, in compliance with Energy Star per the following:
    - a. Energy Star: minimum Initial SRI (Solar Reflectance Index) of 78.
- B. Cover tape: Cured butyl membrane, provided by roof manufacturer.
- C. Cant strips, tapered edge strips and flashing accessories: Types recommended by manufacturer of roofing membrane, provided at locations indicated and at locations recommended by manufacturer, including adhesive tapes, flashing cements, and sealant.
- D. Flashing material: Manufacturer's standard system compatible with flexible sheet membrane.
  - 1. Provide premolded pipe seals and premolded corners.

### 2.4 ROOF EDGE COPING

- A. Fascia trim/ roof edge: Roofing manufacturer's multi-component aluminum cant dam system, Factory Mutual Inc. certified Class I-90, and shall conform to the following additional requirements:
  - 1. Performance characteristics:
    - a. Edging shall lock membrane, preventing wind pullback.
    - b. Fascia shall freely thermal cycle on spring cant substrate.
    - c. Fascia may be factory modified for true radius application.
    - d. Fabricate assembly such that the fascia may be field installed without fastener penetration of either the roofing membrane or the cant waterdam.
    - e. Factory fabricate all pier miters, fascia sumps and spillouts.
  - 2. Fascia trim, nominal 8.5 inch height, formed aluminum alloy 6063, temper T5 0.063 inch thick.
  - 3. Fascia corners: Factory fabricated, welded fascia, shop finished to exactly match running fascia. Minimum leg length 12 inches.
  - 4. Cant waterdam: G90 galvanized steel, minimum 24 gage, 10'-0" lengths.
    - a. Provide galvanized fasteners securing cant dam in place, spaced not greater than 24 inches on center on back edge, and 12 inches on center on roofing side.
- B. Fasteners: As recommended by fascia manufacturer for particular substrate encountered. No exposed fasteners permitted.

## 2.5 WOOD BLOCKING AND NAILER MATERIALS

- A. Pressure preservative treated solid lumber for blocking, nailers and curbs as indicated or required: Hem Fir, Douglas Fir, Eastern Spruce, Eastern Hemlock, or Southern Pine, surfaced dried stud or utility grade. Wood members shall be of sizes indicated on the Drawings or of the same size as the members being braced.
  - 1. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
  - 2. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
- B. Pressure preservative treated plywood for unspecified exterior applications (including plywood blocking, nailers, and backing for roofing and flashing work) : APA graded B-C, Exposure 1, EXT, Group 1 species, 5 ply/5 layer plywood, touch-sanded, thickness as indicated on approved shop drawings.
- C. Pressure Preservative Treatment (PT):
  - 1. General: Treated wood products shall be produced by a single treatment plant, fully licensed by the chemical manufacturers, and conforming to the requirements specified herein.
    - a. Toxicity and Environmental Quality:
      - 1) Products containing chromium will not be permitted.
      - 2) Products containing arsenic will not be permitted.
    - b. Kiln dry all treated lumber and plywood to the following maximum moisture content after treatment.
      - 1) Lumber: 19 percent.
      - 2) Plywood 15 percent.
      - 3) Discard pieces with defects which might impair quality of work.
    - c. Quality marks: Each piece of lumber and plywood shall be permanently affixed with a quality mark, containing the following information:
      - 1) Identification of the inspection agency.
      - 2) Standard to which material was treated.
      - 3) Identification of the treating plant.
      - 4) Preservative treated wood shall include: Retention and end use for which product is suitable.
  - 2. Pressure preservative treated wood. Designated as "PT"
    - a. Chemical Manufacturer: Subject to compliance with the requirements specified herein, Products which may be incorporated in the work include:
      - 1) Osmose, Inc., Griffin GA., product "NatureWood".
      - 2) Universal Forest Products, Inc., Grand Rapids MI., product "ProWood ACQ".
      - 3) Viance, LLC., Charlotte, NC., product "Preserve"
    - b. Treatment: Ammoniacal Copper Quaternary Compound (ACQ), arsenic-free and chromium-free chemical "ACQ Preservative" in accordance with AWPA Standards. Apply the preservative in a closed cylinder by pressure process in accordance with AWPA Standard C15.



- 1) Minimum preservative retention for floor plates, framing, lumber and plywood above ground use: 0.25 pounds per cubic foot (4.0 kg/m<sup>3</sup>) of ACQ chemical, in accordance with AWPA UC1, UC2, UC3A, and UC3B, or NER-643 as appropriate.
  - 2) Minimum preservative retention for framing, lumber and plywood in contact with water, ground, concrete and masonry: 0.40 pounds per cubic foot (6.4 kg/m<sup>3</sup>) of ACQ chemical, in accordance with AWPA UC4A, UC4B, UC4C, or NER-643 as appropriate.
  - 3) Minimum preservative retention for lumber and plywood in permanent wood foundations: 0.60 pounds per cubic foot (9.6 kg/m<sup>3</sup>) of ACQ chemical, in accordance with AWPA UC4B, or NER-643.
- c. Fixation of Chemical: Treated wood shall not be shipped from treatment plant until fixation of the preservative has occurred in the wood.

## 2.6 ACCESSORIES

- A. Plywood decking: Pressure Preservative Treated, 3/4 inch (19.1 mm) thick having a minimum span rating 48/24, APA RATED SHEATHING, STRUCTURAL 1, exposure durability classified, EXPOSURE 1, touch-sanded.
- B. Membrane adhesive (bonding adhesive): As recommended by membrane manufacturer for particular substrate and project conditions, formulated to withstand minimum 60 psf uplift force.
- C. Cut edge sealant for sealing the exposed edge of the splices shall be as recommended by membrane manufacturer.
- D. Water cutoff mastic for non-exposed compression seals, shall be as recommended by membrane manufacturer.
- E. Night sealer shall be as recommended by membrane manufacturer.
- F. Prefabricated elastomeric accessories (pipe seals, inside and outside comers) shall be "weldable" type, as manufactured and recommended by membrane manufacturer. Use of peel and stick type accessories is not acceptable.
- G. Seam Fastening Plates: 2 inch diameter metal plate used for additional membrane securement.
- H. Termination bars: Minimum 1/8-inch thick formed Type 304 Stainless steel, of channel profile with 1/4-inch legs and 1 inch minimum width. Termination bar shall be factory punched to accept fasteners 4 inches on-center. Install with stainless steel screw fasteners.
- I. Fasteners:
  1. For roofing system components: Steel fastener with fluorocarbon coating, complying with FM 4470 corrosion resistance test.. Minimum thread diameter 0.22 inches and minimum shank diameter of 0.172 inches, as recommended by roofing manufacturer. Nail type fasteners are not permitted.
  2. For ACQ pressure preservative treated (PT) wood: Flat head type 304 or 316 stainless steel only, wood screws and carriage bolts, of the appropriate sizes

for specified wind loading. Aluminum, galvanized steel, and coated metal fasteners are prohibited with PT wood.

3. Masonry fasteners: Round head stainless steel screw and neoprene washer with lead expansion anchor as recommended by membrane manufacturer. Manufacturers offering masonry fastener products which may be considered equal, include the following:
  - a. Dur-O-Wal Inc., Dayton, OH.
  - b. Hilti Corporation, Tulsa OK.
  - c. Rawlplug by the Rawlplug Company, Inc., New Rochelle NY.
  
- J. Miscellaneous materials: Best grade or quality approved by the roofing manufacturer for the specific application.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify edge nailers, curbs and penetrations are in place prior to roofing, so that the roof system can be installed as continuously as possible.
- C. Verify the roof deck, and related surfaces are clean, smooth, flat, free of depressions, waves, or projections, properly sloped to drains, and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice. Confirm dry deck by moisture meter with 12 percent maximum moisture content.
- E. Any condition requiring correction or completion shall be corrected or completed prior to the installation of the roofing system. Notify General Contractor of unacceptable conditions.
- F. Do not proceed until defects are corrected.
- G. Verify sizing of existing roof drain plumbing.
- H. Beginning of installation means acceptance of existing substrate and site conditions.

#### **3.2 PREPARATION**

- A. During the operation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.
- B. Carefully broom clean substrate immediately prior to roofing application.
- C. Where surface joints at roof and wall substrates exceed 1/4-inch width, fill flush with surface with pourable sealer before proceeding with the installation.

### 3.3 EMERGENCY MATERIALS AND PROCEDURES

- A. Maintain continuous temporary protection prior to and during installation of new roofing system. Do not leave unfinished roof areas uncovered over-night or during inclement weather.
  - 1. Provide temporary protective sheeting over uncovered deck surfaces.
  - 2. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights or temporary fasteners.
  - 3. Provide for surface drainage from sheeting to existing drainage facilities.
  - 4. Do not permit traffic over unprotected or repaired deck surface.
- B. Maintain on site equipment and materials necessary to apply emergency temporary coverage in the event of sudden storms or inclement weather.
- C. Do not install more insulation than can be covered by roofing system in the same workday. Do not apply more roofing than can be properly fastened and fully sealed in the same workday. Ensure that water does not flow beneath any completed sections of the roofing system, provide temporary closures.
- D. Roofing Subcontractor is fully responsible for all damage due to water penetration occurring during the Work of this Section.

### 3.4 INSTALLATION - GENERAL

- A. The entire work of this Section shall be performed in accordance with the best standards of practice relating to trades involved.
- B. Follow local, state and federal regulations, safety standards and codes. When a conflict exists, the more restrictive document shall govern.
- C. Follow insurance underwriter's requirements acceptable for use with specified products or systems.
- D. Review all special conditions, such as at projections, at connections to sheet metal gravel stops, flashings with the Roofing Manufacturer, submit the Roofing Manufacturer's recommendations and details to the Architect for approval.
- E. Special Cautions:
  - 1. Do not use oil-based or plastic roof cement.
  - 2. Do not subject elastomeric materials to contact with petroleum, grease, oil, solvents, vegetable or mineral oil, nor animal fat. Prevent contact with hot pipes, and ducts.
  - 3. Cements and bonding adhesive contain petroleum distillates and are extremely volatile and flammable. Avoid breathing vapors and do not use near fire or flame.
  - 4. Ensure that splicing and bonding surfaces are dry during installation.
- F. No Ponding: Ensure all roof areas properly drain, without depressions resulting in ponding of water. Areas of minor surface depressions 2 square feet or greater having a depth of 0.25 inch (6mm) or greater in depth shall be repaired to prevent possible ponding of the system.

### 3.5 INSTALLATION - ROOF NAILERS AND BLOCKING

- A. General: Provide anchorage for nailers as required for roof and edging to obtain specified wind loading requirements.
  - 1. Secure nailers and blocking to metal deck with electro-galvanized screws at not greater than 12 inch on center spacing, extending a minimum of 3/4-inch below deck.
  - 2. Secure nailers and blocking to wood substrates with electro-galvanized screws at not greater than 12 inch on center spacing, extending a minimum of 1-1/2 inch into board substrates and 3/4 inches into sheet materials.
- B. When building up layers of nailers and blocking, fully secure each layer to at least the one below, alternating location of fasteners, spacing at 12 inches on center. Provide fasteners in lengths to penetrate through more than one substrate layer of blocking. Stagger locations of butt ends of boards, such that no two joints are "lined up".
- C. Ensure finished height of nailers is same as top surface of roof insulation within 1/4-inch, plus or minus.

### 3.6 MEMBRANE - ADHERED INSTALLATION

- A. Roll out membrane, inspect sheet for defects as it is being rolled out. Align sheet to that it overlaps the previous sheet by the lap width recommended by the manufacturer, but not less than 3 inches.
- B. Fold membrane back on itself and coat the bottom side of the sheet and the top side of the deck with adhesive. Do not get adhesive in the lap joint area.
- C. After adhesive has been allowed to set in accordance with the manufacturers requirements, roll the membrane into the adhesive, free from air pockets, wrinkles, or tears. Firmly press sheet into place without stretching.
- D. Broom or roll membrane to assure full contact with adhesive, as recommended by roofing manufacturer.
- E. Provide additional membrane securement at the perimeter of roof, at expansion joints, curbs, skylights, and similar roof top penetrations, at interior wall and penthouse perimeters, and at any angle change which exceeds 2 inches in on horizontal foot.
  - 1. Install continuous reinforcement strips 3 inches to 6 inches from inside and outside corners where additional membrane securement is required and where recommended by roofing manufacturer. Secure reinforcement strips with 2 -inch diameter aluminum or stainless steel seam fastening plates; space fastening plates not greater than 12 inches on center.
  - 2. Install reinforcement strips either horizontally into deck or vertically into curbs as recommended by roofing manufacturer.
  - 3. Splice membrane flashing over installed fastening plates and reinforcement strips as recommended by roofing manufacturer, and in no case provide flashing of less than 6 inches in width, and at ends of flashing, provide a minimum 2 inch splice from edge of plate/strip.

- F. Extend membrane up cant strips and a minimum of 8 inches onto vertical surfaces.
- G. Welding of seams: Clean and dry splice joint areas of both membrane sheets. Heat-weld all joints and lap seams permanently waterproof, without wrinkles and voids using manufacturer's recommended heat seaming methods, and as follows.
  - 1. Clean the seam prior to welding using water, scouring powder and cotton cloths. Rinse al soap and wipe dry.
  - 2. Minimum seam width is 3 inches with at least 1-1/2 being welded
  - 3. To greatest extent possible, utilize an automatic heat welding machine for all field splices on the horizontal plane, including flashing.
  - 4. Utilize hand-heal welders on vertical welds, repair patches, and where an automatic heat welder is not practical.
  - 5. To ensure proper seam strength, perform practice welds to adjust machine (air intake, temperature and speed) on spare membrane sheets. Do not perform practice welding on installed roof membrane.
  - 6. After the sheet has cooled probe all seams and use a hand held welder and silicone covered roller to repair any voids in seams. Apply constant pressure against the seam edge to feel for voids, loose areas or poor welds. Probing and repair of voids is to be done on a daily basis.
  - 7. Test seams periodically and when ambient temperatures change to ensure proper welds are being achieved.
    - a. Perform destructive tests of seams at the beginning of each work day.
    - b. Perform destructive tests of seams every time there is an interruption in the welding process which includes, but is not limited to:
      - 1) Power failure.
      - 2) Welder shut down.
      - 3) Job site conditions change.
      - 4) After personnel breaks, lunch and similar interruptions.

### 3.7 INSTALLATION - MEMBRANE FLASHINGS

- A. Walls and curbs:
  - 1. Prepares surfaces to receive membrane flashing. Surfaces must be dry, and smooth enough to achieve at least 75 percent adhesion.
  - 2. Flash to height shown on Drawings, but not less than 8 inches.
  - 3. Terminate the top of all flashings with fasteners spaced 12 inches on center maximum. Where flashings are not protected by a counter flashing, provide a surface mounted termination bar.
  - 4. Bond flashing o substrate as directed by manufacturer's instructions; roll or broom surface to achieve full contact with substrate.
  - 5. Install premolded corners.
- B. Pipe penetrations:
  - 1. Utilize manufacturer's premolded pipe seals where practical. Weld pipe seal to roofing membrane. Apply a bead o cut-off mastic between the pipe and the inside of the pipe seal. Install and tighten the pipe clamp at the top of the pipe seal.

2. At larger penetrations provide field fabricated flashings, fully heat welded watertight. Secure top edge of flashings with pipe clamp and seal with manufacturer's approved sealant. Counterflash termination with manufacturer's flexible flashing, with all edge sealed, as shown on the drawings or required by the manufacturer for the specified warranty.
  3. Use of pitch pockets is prohibited.
- C. Drains:
1. Taper insulation to make a smooth transition to the drain. Keep all roofing seams at least 18 inches from drains. Cut a holes in the membrane for drain pipe for drain clamp ring bolts.
  2. Place a bead of cut-off mastic around the seat of the drain, and install clamping ring and tighten all bolts.
  3. Ensure each drain is protected from blockage by debris.
  4. Test each drain and ensure that no leakage occurs.
- D. Provide self adhering, butyl based membrane transitions at all TPO membrane extents and as shown on the drawings.
- E. Sheet metal copings, fascias, gravel stops, and flashings will be furnished and installed under Section 07 62 00 - SHEET METAL FLASHING AND TRIM.

### 3.8 INSTALLATION METAL FLASHINGS - GENERAL

- A. Except as otherwise shown on the reviewed shop drawings or specified herein, the workmanship of sheet metal work, method for forming joints anchoring, cleating, provisions for thermal movement, shall conform to the standard details and recommendations of the sheet metal producer and those of producer organizations and research institutions and associations concerning the sheet metal used, in addition to the standards and details set forth in the referenced materials specified this Section.
- B. Face nailing will not be permitted, concealed cleating or other concealed method must be used to attach sheet metal work to structure.
- C. Ensure that fastenings do not exceed 8 inches on centers. Use flat head fasteners throughout, and seal all fastener heads after installation thereof.
- D. Fill all slip joints and overlapping surfaces in the assembly with specified sealant material, removing all excess sealant material from the prefinished surfaces immediately, to prevent staining the finish.

### 3.9 INSTALLATION – ROOF EDGE COPING

- A. Coordinate with roofing installer prior to installation. Verify site conditions and manufacturer's roof edging details. Comply with roof edging manufacturer's installation instructions and recommendations.
- B. Nail galvanized spring clip in continuous manner to vertical face of wood nailers. Locate fasteners 3/4 inch below roof edge and 12 inches on center using a minimum 1-1/2 inch galvanized roofing nail. Allow 1/4 inch gap between sections of spring clip.

- C. Lay roofing membrane over the spring clip allowing it to extend down the face to the drip edge. Locate and hang joint covers at all joints between corners and straight sections.
- D. Hook each fascia section over the top of the spring clip and membrane. Press down on the fascia until the drip edge is engage. Allowed 1/8 to 1/4 inch gap for expansion (as recommended by manufacturer).

### 3.10 FIELD QUALITY CONTROL

- A. General: Field inspections will be performed under the provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Owner's testing: At the owner's discretion, he/she may engage a testing agency to perform testing of the roofing assembly, including but not limited to the following:
  - 1. Flood testing of drain assemblies.
  - 2. Infrared imaging of the roofing assembly
  - 3. Moisture content testing of roofing materials
- C. Roofing Subcontractor to correct all deficiencies in roof as determined by roof sample analysis and as prescribed by roof system manufacturer. Should additional samples be required, these cost will be borne by the roofing applicator.
- D. Fastener Pull-out testing. Prior to installation of roofing membrane, obtain a independent testing agency approved by the Architect for each separate roofing area pull out resistance. Report findings to Architect and the roofing manufacturer. Perform testing testing per ANSI/SPRI FX-1-2001 - Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners, without additional cost to the Contract.
  - 1. Testing frequency: Ten tests per initial 50,000 square feet (or less) and five additional pullouts for each additionally 50,000 square feet, or portion thereof for each section of roof.
- E. Heat Welded Seam Testing:
  - 1. Test cuts: Provide test cuts through seams and joints as representative sample of workmanship. For each welding machine used, provide not less than three test cuts per day of roofing work. Identify on roof plan locations of all test cuts. Label each test cut by a unique identifier, including date of cut.
  - 2. Verification procedure: Cutting a 1 inch wide strip of the membrane through a heat-welded seam. Each end of the sample is then pulled in opposite directions until failure. Acceptable samples result in failure of the membrane prior to separation of the weld. The contractor shall date and retain each sample on site throughout the duration of the project to allow for inspection by roofing manufacturer, Architect, and Owner.
  - 3. Frequency: As required by the roofing manufacturer but no less than three per day, or every time the machine is reset or restarted. Additionally test hand-welded seams a minimum of three times per day.
- F. Roofing subcontractor to correct all deficiencies in roof as determined by roof sample analysis, and as prescribed by roof system manufacturer. Should additional samples be required, these cost will be borne by the roofing applicator.

3.11 CLEANING

- A. Remove elastomeric adhesive markings from finished surfaces.
- B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.
- C. Repair or replace defaced, or disfigured finishes caused by the work of this Section.

End of Section



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Section 07 61 20

FIELD-FORMED STANDING SEAM METAL CLADDING

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
  - 1. Custom fabricated, Tin/zinc alloy-coated copper wall cladding at dormers and backs of gables, associated integral flashings, slip sheet, underlayment and protection membrane.
  - 2. Custom fabricated, Tin/zinc alloy-coated copper Field formed window surrounds, associated integral flashings, slip sheet, underlayment and protection membrane.
  - 3. Vapor barrier.
  - 4. Related flashings and running sheet metal work, for all non-specified locations in conjunction with the roofs.
  - 5. Sealant in conjunction with metal work furnished hereunder, and plastic wedges for cap flashings terminating in reglets.
- B. Furnish the following products to be installed under the designated Sections:
  - 1. Placement of flashing reglets and accessories by Section 04 20 00 - UNIT MASONRY.

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Roof deck construction with sheathing, wood blocking, and nailers.
- B. Section 07 62 29 - SHEET METAL FLASHING AND TRIM: Gutter, rain leaders and ridge caps.
- C. Section 07 72 00 - ROOF ACCESSORIES: Roof hatches.
- D. Section 07 92 00 - JOINT SEALANTS: Sealant.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM B 32 - Solder Metal.

2. ASTM B 152 - Specification for Copper, Sheet, Strip, Plate and Rolled, Bar.
3. ASTM B 370 - Copper Sheet and Strip for Building Construction.
4. ASTM B 486 - Paste Solder.
5. ASTM B 694 - Standard Specification for Copper, Copper-Alloy, Copper-Clad Bronze (CCB), Copper-Clad Stainless Steel (CCS), and Copper-Clad Alloy Steel (CAS) Sheet and Strip for Electrical Cable Shielding
6. ASTM D 4586 - Asphalt Roof Cement, Asbestos-Free.
7. FS O-F-506 - Flux, Soldering, Paste and Liquid.
8. FS QQ-C-576b - Copper Flat Products, (Plate, Bar, Sheet and Strip).
9. FS QQ-S-571 - Solder, Tin Alloy.
10. CDA - Copper in Architecture Handbook.
11. SMACNA - Architectural Sheet Metal Manual 7<sup>th</sup> Edition (January 2012), referred to herein as "Sheet Metal Manual".
12. Revere Copper Products, Inc., Rome NY. - Copper and Common Sense, 8th edition.

#### 1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  1. Literature: Manufacturer's data sheets for each metal type and accessories furnished hereunder, include material specifications, performance data, physical properties and finishes.
  2. Shop drawings:
    - a. Fully dimensioned large scale design details of all conditions showing material profiles, splices, flashing terminations and other jointing details, fastening methods and installation details. Indicate material type, sizes, and weights or gages. Indicate extent of adjacent work specified under other Sections of the Specifications.
    - b. Fully detail methods of relieving stresses due to thermal movement, including sealing of expansion seams.
  3. Verification samples:
    - a. 36 by 36 inch square sample of unfinished copper roofing and siding mounted on plywood packing illustrating typical seam, external corner, internal corner, valley, and ridge junctions to vertical dissimilar surface, illustrating material and workmanship.
      - 1) Maintain sample on site as an acceptable example of work.
    - b. Snow guards. Submit fabricated typical snow guard.
  4. Sustainable Design Submittals:
    - a. Recycled content (LEED Credit MRc4): Provide manufacturer's written certification of recycled content as defined in accordance with International Standard ISO 14021-1999, Environmental Labels and Declarations—Self-Declared Environmental Claims (Type II Environmental Labeling). Indicate post-consumer and pre-consumer recycled content and provide documentation certifying products are from recycled sources.

- b. Local/regional materials (LEED Credit MRc5):
  - 1) Indicate location of content of extraction, harvesting, and recovery; indicate the distance between extraction, harvesting, and recovery and the project site. Indicate percentage of product content from qualified locations.
  - 2) Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
- c. Adhesives and Sealants (LEED Credit IEQc4.1): Include certification of data indicating Volatile Organic Compound (VOC) content of all field-applied adhesives and sealants indicating compliance with South Coast Air Quality Management District, (SCAQMD) Rule 1168 – VOC Limits (VOC limits in effect on July 1, 2005 and rule amendment date of January 7, 2005). Submit MSDS highlighting VOC limits.

#### 1.6 QUALITY ASSURANCE

- A. Fabricator and Installer: Companies specializing in fabrication and installation of custom copper roofing with minimum 5 years documented successful experience.
- B. Perform work in accordance with CDA and SMACNA standard details and requirements.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store, and protect and handle products to site under provisions of Section 01 60 00 - PRODUCT REQUIREMENTS,
- B. Store preformed material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

#### 1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of sheet metal roofing work with the various trades responsible for installing interfacing materials, and install the work at appropriate times so as not to delay the progress of related work.

#### 1.9 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Special Warranties:
  - 1. Roofing Installer's Warranty: Furnish special roofer's warranty or bond for coverage leaks and faulty or defective materials and workmanship for a Period of 3 years from Date of Substantial Completion.
    - a. Warranty includes: All costs and expenses to be make repairs or replacements to installed work as necessary to correct faulty and defective work, and as are necessary to maintain said work in a watertight condition. Warranty shall include provision to repair or replacement metal roofing

- work which demonstrates defects in structure, watertight integrity, or appearance, including, but not limited to the following:
- 1) Failure to meet specified performance requirements.
  - 2) Loose parts.
  - 3) Leaking (including integrity of seals).
  - 4) Wrinkling.
  - 5) Buckling.
  - 6) Degradation of metal finish.
  - 7) Galvanic action between roofing and dissimilar materials.
- b. Warranty excludes: damages to work and other parts of the building, and to building contents, caused by:
- 1) Lightning.
  - 2) Peak gust wind speed exceeding 110 mph.
  - 3) Fire.
  - 4) Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition.
  - 5) Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work.
  - 6) Vapor condensation on bottom of roofing.
  - 7) Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
- c. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
- d. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
- e. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
- f. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

## PART 2 - PRODUCTS

### 2.1 COPPER MATERIALS

- A. Tin/Zinc Alloy-Coated Copper: Cold-rolled sheet copper natural finish, conforming to ASTM B 370, temper H00, having a minimum weight indicated below, and coated with an intermediate layer, a hot-dipped tin/zinc alloy coating 0.5 mils thickness, and a protective wash coat.
  - 1. Revere Copper Products Inc. Rome NY., Product: "Freedom Grey Z-T Coated Architectural Sheet Copper".
  - 2. Minimum weight: 20 ounces per square foot.

### 2.2 ACCESSORIES

- A. Slip sheet: Rosin sized building paper.
- B. Z-Clip girts: 3-1/2 inch deep z-shape hot-dipped galvanized to G90 coating, designed to accommodate expansion and contraction, dynamic movements and design load requirements; provide plastic shims as thermal separator between applied copper, and sub-girts
- C. Fasteners Copper: of sizes most appropriate for the specific application, and equipped with soft neoprene washers.
- D. Insulation: 3-1/2 inch mineral wool as specified under Section 07 21 00.
- E. Sealant in conjunction with metal work: Sealant Type "SE" and backer materials as specified under Section 07 92 00 - JOINT SEALANTS.
- F. Solder: Conforming to ASTM B 32 with non-acid flux.
  - 1. For use with plain copper sheet: Solder: 50 percent tin / 50 percent lead solder.
- G. Flux: FS O-F-506.
- H. Primer for protection membrane: As recommended by membrane manufacturer.
- I. Clips for flashing and counter flashing: 20 oz cold-rolled soft-temper sheet copper conforming to ASTM B 101, Type 1, Class A. coated at a rate of 7-1/2 pounds per side per 100 square feet.

### 2.3 FORMWORK AND FLASHINGS - GENERAL

- A. General: Form and fabricate sheets, seams, cleats, valleys, ridges, edge treatments, integral flashings and other components to profiles, patterns and drainage arrangements shown and as required for permanently leakproof construction. Provide for thermal expansion and contraction of the work as indicated. Shop fabricate materials to the greatest extent possible.
- B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance. To the greatest extent applicable, fabricate sheet metal components in shop, and thoroughly clean all joints on both sides of the sheet metal work.

- C. Fabricate cleats and starter strips of same material as sheet interlockable with sheet.
- D. Form flashings as required, or to profiles indicated on the Drawings, to protect materials from physical damage and shed water.
- E. Fabricate flashing corners from one piece with minimum 18 inch long legs, seam and solder for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys or eaves.
- B. Verify deck is dry and free of snow or ice. Verify joints in wood deck are solidly supported and fastened.
- C. Verify correct placement of wood nailers and blocking.
- D. Verify curbs, pipes, sleeves, ducts, or vents through roofing are solidly set, cant strips and reglets in place.
- E. Beginning of work shall constitute acceptance of the conditions of the surfaces to which this work is to be applied.

#### **3.2 PREPARATION**

- A. Repair sheathing/decking substrate before installing the protection membrane; sheathing/decking shall have no voids, damaged, or unsupported areas.
- B. Field measure site conditions prior to fabrication.
- C. Install starter and edge strips, and cleats before starting installation.
- D. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.
- E. Insert flashings into reglets to form tight fit. Secure in place with lead wedges at a maximum of 8 inches on center. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.
- F. After soldering, wash metal clean with neutralizing solution and rinse with water. Seal metal joints watertight.
- G. During the installation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.3 TINNING AND SOLDERING REQUIREMENTS.

- A. Perform soldering slowly with well-heated coppers, thoroughly heat the seam and sweat the solder through its full width. When soldering lead-coated copper brush a liberal amount of flux into the seam.

3.4 INSTALLATION - GENERAL

- A. Except as otherwise shown on the reviewed shop drawings or specified herein, the workmanship of sheet metal work, method for forming joints anchoring, cleating, provisions for thermal movement, etc., shall conform to the standard details and recommendations of the sheet metal producer and those of producer organizations and research institutions and associations concerning the sheet metal used, in addition to the standards and details set forth in the referenced materials specified this Section.
- B. Face nailing will not be permitted, concealed cleating or other concealed method must be used to attach sheet metal work to structure.
- C. Fill all slip joints and overlapping surfaces in the assembly with specified sealant material, removing all excess sealant material from the prefinished surfaces immediately, to prevent staining the finish.
- D. Apply slip sheet in single layer laid perpendicular to slope; weather lap edges 2 inches and nail in place. Minimize nail quantity.
- E. Cleat and seam all joints between metal and bitumen or metal and felts.
- F. Stagger transverse joints of sheets.
- G. Solder lap and intersection joints. After soldering, wash metal clean with neutralizing solution rinse with water.
- H. Face nailing will not be permitted, concealed cleating or other concealed method must be used to attach work to structure.
- I. Ensure that flashing fastenings do not exceed 8 inches on centers. Use flat head fasteners throughout, and seal all fastener heads after installation thereof.
- J. Fill all slip joints and overlapping surfaces in the assembly with specified sealant material, removing all excess sealant material from the prefinished surfaces immediately, to prevent staining the finish.

3.5 INSTALLATION -STANDING SEAM ROOFING

- A. General: Fabricate standing seam roofing in accordance with SMACNA Architectural Sheet Metal Manual 6<sup>th</sup> Edition, Chapter 6, and as additionally specified herein.
  - 1. Conform to SMACNA Architectural Sheet Metal Manual details, Figures 6-5 (detail 2), 6-6 and 6-7 in specified metal gage.
- B. Lay sheets with long dimension perpendicular to eaves. Lock cleats into seams and flatten in direction of drainage.
- C. At eaves and gable ends, terminate roofing by hooking over edge strip.

- D. Finish standing seams one inch high. Bend up one side edge 1-1/2 inch and other edge 1-3/4 inch. Make first fold 1/4 inch wide single fold and second fold 1/2 inch wide, providing locked portion of standing seam, five plies in thickness.
- E. Fold lower ends of seams at eaves over at 45 degree angle. Terminate standing seams at ridge and hips by turning down with tapered fold.

### 3.6 INSTALLATION - FLAT SEAM SIDING

- A. General: Fabricate flat seam siding in accordance with SMACNA Architectural Sheet Metal Manual and as additionally specified herein.
  - 1. Conform to SMACNA Architectural Sheet Metal Manual details.
- B. Fabricate sheets into 16 by 18 inch rectangles, notch corners and fold over pretinned edges 3/4 inch.
- C. Lay sheets with long dimension horizontal with cross joints staggered. Fasten sheets with cleats.
- D. Place cleats on the long side at the center of each sheet and adjacent to the intersections of the cross seams. On cross seams place two cleats per seam.
- E. Lock cleats into seams; flatten smooth in direction of water flow, Sweat seams thoroughly with solder, producing watertight joints.
- F. Notch corners and turn up pretinned edges 3/4 inch.

### 3.7 INSTALL SNOW GUARDS

- A. Install snow guards as recommended by manufacturer using snow guard manufacturer's recommended adhesive, without damage to roofing finish.
  - 1. Provide snow guards in configurations indicated on the Drawings

### 3.8 CLEANING

- A. Remove all flux, scraps and dirt immediately. Neutralize excess flux with solution of washing soda and clean water as recommended by CDA.
- B. Daily clean work areas by sweeping and disposing of debris.
- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section



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Section 07 62 29  
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Description of existing assemblies: Sheet metal flashing exists at the building's roofs and at masonry assemblies at and above the roofs.
- B. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, including, but not limited to, the following:
1. Field-verification of conditions and dimensions of existing sheet metal assemblies.
  2. Protection of existing sheet metal assemblies indicated to remain without repair or replacement.
  3. Selective removal of sheet metal assemblies as indicated on the drawings.
  4. Sheet metal flashing at:
    - a. Roof slope changes.
    - b. Roofing material changes.
    - c. Roof penetrations, including but not limited to pipe penetrations.
    - d. Through-wall flashings at masonry walls.
    - e. Flashings at stone copings.
    - f. Counterflashings.
    - g. Ridges.
    - h. Valleys.
  5. Rain leaders. Note that new rain leaders should connect to existing receptor boots at grade, and should include a new "wye" cleanout in the lowest section of the rain leader.
  6. Flat-seam metal roofing, including both low-pitch and bathtub roofs.
  7. Separators at dissimilar metals where any work of this Section is performed, in the form of coatings, sheet membranes, or physical separation to prevent galvanic action.
  8. Self-adhered-membrane underlayment and separation layer under all metal flashing and sheet metal coping as indicated on the drawings.
  9. Pre-construction testing of existing internal rain leaders to which roof drainage systems, partially included in this section, conduct storm water.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
1. Requirements related to hazardous building materials including but not limited to asbestos are indicated in Division 02 Section ASBESTOS ABATEMENT.
  2. General requirements related to selective removal of existing sheet metal flashing and trim is indicated in Division 2 Section SELECTIVE DEMOLITION.
  3. Sheet metal weather cap trim at masonry joints is indicated in Division 4 section STONE MASONRY RESTORATION.
  4. Slate Shingle roofing is indicated in Division 7 Section, SLATE SHINGLES.

5. Metal flashing at window openings is indicated in Division 7 Section, ALUMINUM WINDOWS.
6. Repairs to existing gypsum panel roof deck are indicated in Division 7 Section, SLATE SHINGLES.
7. Bird deterrent is indicated in Division 10 Section, BIRD DETERRENT.

## 1.2 SUBMITTALS

- A. Certifications by the producers of all materials that all materials supplied comply with all the requirements of the referenced standards and that all materials are suitable for the use specified herein.
- B. Samples of all materials specified, each properly labeled with associated specification section, and manufacturer's product data and installation recommendations.
- C. Material Safety Data Sheets (MSDS) for all materials to be used.
- D. Shop drawings based on field measurements by the Contractor. Show the following:
  1. Section details for all detail conditions shown in the drawings, including the following:
    - a. Flashing integration with adjacent metal and membrane roofing and cladding. Show all adjacent flashing in its entirety, including exact profiles, lengths, joints, terminations, and methods of attachment.
- E. Submit the following under provisions of Section 01 33 00 - Submittal Procedures:
  1. LEED Submittal Requirements:
    - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
      - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
        - a) a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
        - b) b) EPD shall have at least Cradle to Gate scope,
      - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
    - b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
      - 3) Recycled Content:
        - a) a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
        - b) b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
      - 4) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.

- a) a) Documentation should be in the form of one of the following:
  - b) b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
  - c) c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
  - d) d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
  - e) e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
  - f) f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
- 5) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an HPD.
- F. Contractor Qualifications:
- 1. The Contractor performing the work of this Section shall have a minimum of five years' experience in comparable metal flashing work including a minimum of three buildings listed in the National Register of Historic Places (or comparably designated at the city or town level) in the last five years and employing workers skilled in the restoration processes and operations indicated.
  - 2. Provide the name of each person who will be performing the Work and their employer's name, business address, and telephone number.

### 1.3 QUALITY ASSURANCE

- A. FM Global Standards: Provide installation and products in conformance with standards of Factory Mutual Insurance Company (FM Global) applicable, at the location of the Project, to work indicated in this Section.
- B. Owner's Insurer Approval: Submit to the Owner, via the Architect, any product data, installation drawings and other documents as the Owner may require to obtain approval of the Owner's insurer of installation of work indicated in this Section, before proceeding with the work.

### 1.4 GUARANTEE

- A. In addition to the requirements of the General Conditions, provide a guarantee stating that if any part of the work installed under this Section admits water to the interior of the building during a period of three years from the date of Substantial Completion (as defined in General Conditions), the Contractor shall promptly replace the defective components at no cost to the Owner. This guarantee shall cover labor and materials and shall not be prorated.

## 1.5 MOCKUPS

- A. Working in conjunction with the related sections, construct full-scale mockups of the following flashing conditions. Include all required flashing, membranes, fasteners, structural attachment steel, roof slate, and other components as required. Notify the Designer at least 48 hours before starting work on each mockup. Reconstruct each mockup as many times as necessary to meet with contract requirements and the approval of the Designer at no additional cost to the Owner. Do not proceed with any part of the work before the Designer approves the appropriate mockups.
1. One exposed coping flashing for top of masonry wall.
  2. One exposed parapet flashing for top of masonry wall
  3. 10 lineal feet of concealed step flashing at dormer.
  4. One valley flashing location.
  5. One ridge flashing location.
- B. The mockups will be used to establish both technical and aesthetic standards for the remainder of the project. The approved mockups may become part of the final roof installation.

## PART 2 - PRODUCTS

### 2.1 LEED REQUIREMENTS

- A. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
1. Provide products with Third Party Environmental Product Declaration (EPD) whenever possible.
- B. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
1. Provide products with publicly available material inventories whenever available.

### 2.2 MATERIALS

- A. Metal Roofing, flashing and Accessories: Cold-rolled sheet copper conforming to ASTM B370 for all items; weights as specified below unless noted otherwise on the drawings. All sheets shall carry markings of producer, temper, and weight.
1. Surface color:
    - a. Grey, unless otherwise indicated.
    - b. Basis of design product: Revere Copper Products "Freedom Gray".
  2. Weights: As scheduled below, and for any item no less than 16 oz.
    - a. At low-pitched metal roofing, through-wall flashing, and stepflashing: 16 oz.
    - b. At gutters and downspouts: 20 oz.
    - c. Flat-Seam Roof Panels: 16 oz.
    - d. All hooks strips, cleats, cover plates, and other accessories: same weight as base and adjacent metal roofing or flashing.

- B. Rivets for Metal Flashing Connections: Solid copper 3/16 in. dia. flat head rivets of proper length for the material being fastened.
- C. Solder: ASTM B32, Class 50A or 50B, Bar Form, 50% block tin and 50% pig lead.
- D. Flux: Conforming to ASTM B813.
- E. Fasteners and Accessories: Use screws, bolts, or nails as required. Nails to be 12 ga, with minimum 1/4 in. diameter flat head, annular threaded, with needle point, and of sufficient length to obtain 1-1/4 in. embedment into blocking and for full depth into plywood.
- F. Anchors for Attaching Metal Flashing to Masonry and Concrete: 1/4 in. nylon expansion sleeves with stainless steel drive pins; provide lengths to obtain 1-1/2 in. penetration minimum into masonry backup. Unless otherwise shown on the drawings, provide minimum 3 in. edge distance on all masonry or concrete fasteners.
- G. Self-Adhered-Membrane Underlayment, Self-Adhered-Membrane Strip Flashing, and Related Accessories (for use below metal).
  - 1. Basis-of-Design product is Grace Ultra, manufactured by GCP Applied Technologies.
  - 2. Self-adhered-membrane underlayment must be designed specifically for high-temperature applications beneath architectural metal roofing; membrane must resist service temperatures of up to 300°F without degradation.
  - 3. Butyl-based adhesive with high-density cross-laminated polyethylene backing.
  - 4. 30 mil (0.76 mm) thickness.
  - 5. Adhesive to be backed by protective plastic release liner.
  - 6. Membrane must have slip-resistant surface.
  - 7. Membrane must be self-sealing.
- H. Primer for Self-Adhered-Membrane Underlayment: As recommended by self-adhered-membrane-underlayment manufacturer. Note all surfaces to receive self-adhered-membrane underlayment shall be primed.
- I. Mastic: As recommended by self-adhered-membrane-underlayment manufacturer.
- J. Dissimilar metal separator: Self-adhering rubber or asphalt-based membrane.
  - 1. Product: Flashing tape manufactured by Protecto Wrap, or approved equal.
- K. Coated Felt Underlayment: ASTM D 2626, asphalt-saturated and coated organic felt, mineral surfaced, unperforated, No. 40, 30 pound, coated two sides
- L. Paper Slip Sheet: 5-lb/square red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.
- M. Sealants: Type II - reference Division 7 Section "Joint Sealants".

## PART 3 - EXECUTION

### 3.1 SHEET METAL FABRICATION

- A. Except as called for in this Section, comply with all recommendations of the current edition of Revere's "Copper and Common Sense" Standards for Details. Completed metal shall be straight, flat, and without buckles, dents, scratches, or other blemishes.
- B. Form sheet metal on a bending brake. Perform shaping, trimming, and hand seaming in the shop as far as practicable, with the proper sheet-metal-working tools. Make the angle of the bends and the folds for interlocking the metal with full regard for expansion and contraction to avoid buckling or other deformation in service. All lines and arisses shall be straight and crisp except where thickness of metal dictates radius bend, and all exposed edges shall be hemmed 1/2 in. minimum.
- C. Immediately prior to soldering, mechanically clean all metal to be soldered with steel wool or by other acceptable means, apply flux, and pre-tin. Clean metal again if it is not soldered on the same work day. Perform all soldering slowly with well-heated heavy (10 lbs per pair) coppers (irons) with properly tinned, clean, blunt tips. Do not use torches. Apply enough heat to sweat the solder completely through the full width of the seam. Close clinch lock seams gently with a block of wood and mallet, then flux and show at least one full inch of continuous and evenly flowed solder. Whenever possible, perform all soldering in flat position. All sloped and vertical seams shall be laced and soldered a second time. Wipe and wash clean soldered joints to remove all traces of acid from the flux immediately after the joints are made.
- D. Arrange work sequence to avoid use of newly completed roofing for storage, walking surface, and equipment movement. Protect work from mechanical damage. Notify the Designer immediately if anyone abuses or damages roofing or flashing components.
- E. Arrange panel layouts properly to ensure all panel penetrations are in the middle of panels. Penetrations at seams in the metal panels are prohibited.
- F. Do not leave the completed self-adhered-membrane underlayment exposed to the elements for more than one month. Remove and replace self-adhered-membrane underlayment that has been exposed for longer than this period.
- G. Cover all self-adhered-membrane underlayment with separator sheet just prior to metal placement. Replace any separator sheet that becomes wet. Do not allow separator sheet to be exposed overnight.
- H. Self-adhered-membrane underlayment is slippery, particularly when wet; take proper safety precautions.

### 3.1 SELF-ADHERED-MEMBRANE-UNDERLAYMENT INSTALLATION

- A. Coordinate self-adhered membrane underlayment work indicated in this section with self-adhered membrane underlayment work indicated in other Division 7 roofing system specification sections.

- B. Prior to all metal roofing, flashing, and cladding installation, inspect the self-adhered-membrane underlayment for holes and tears in the membrane. Provide repair patches and liquid membrane at edges and at all deficiencies. Extend repair patches a minimum of 6 in. beyond the tear on all sides.

### 3.2 GENERAL METAL INSTALLATION

- A. Prior to all flashing installation, inspect the self-adhered-membrane underlayment for holes and tears in the membrane. Provide repair patches and liquid membrane at edges, and at all deficiencies. Extend repair patches a minimum of 6 in. beyond the tear on all sides.
- B. Detail expansion joints in all flashing pieces to provide a watertight connection, and allow for expansion/contraction of the metal at each joint as shown on the drawings. Unless shown otherwise on the drawings, provide expansion joints at 20 feet o.c. and at 2 feet away from all changes in flashing direction (each side) and from all terminations of flashing.
- C. Provide pre-fabricated corner pieces with joints locked, riveted, and soldered watertight.
- D. Space rivets at 1 in. o.c. in staggered pattern unless otherwise indicated.
- E. Provide backer plate as required at flashing transitions and corners to fully solder watertight.

### 3.3 METAL FLASHING INSTALLATION

- A. Provide metal flashing systems as shown on the approved shop drawings. Coordinate metal flashing details with other shop drawings. Provide separation layer between self-adhered-membrane underlayment and all metal flashing
- B. Provide continuous hook strips where indicated on the drawings, nailed 6 inches on center into solid wood blocking, 12 in. o.c. into stone or concrete. Crimp the formed hook of metal flashing onto the hook strip, forming a 3/4 in. loose lock, overlapping the hook strip at least 1/2 in.
- C. Provide integral splices in the metal edge flashing, as detailed. Provide a full bead of sealant, as specified in Section – JOINT SEALANTS, in splice joints prior to installation.
- D. Provide individual valley sheets. Nail the upper end of each piece to the deck, attach side edges with 2 in. wide metal cleats at 12 in. o.c. Lap valley sheets a minimum of 1 ft at transverse joints.
- E. Provide metal flashing into saw-cut reglets) as shown on the drawings, fastening the upturned leg of flashing in the reglet at 6 in. o.c. Coordinate with sealant installation into reglet joints as specified in Section – JOINT SEALANTS.
- F. Provide metal skirt flashing with 2 in. wide loose cleats at 12 in. o.c., to cover the top of the metal and membrane flashing where shown on the drawings. At transverse joints, lap the adjacent skirt flashings, a minimum of 2 in. Bend the bottom edges of the skirt to

form a smooth surface and the top to hook into the flashing receiver. Do not solder cleat to skirt.

- G. Provide flashing at roof eaves and changes in slope as detailed, attached to the substrate as shown on the drawings.
- H. At lap joint, overlap flashing pieces 6 in. minimum and fill lap with sealant.
- I. At all rising walls, gap metal flashing from rising wall by 1/4 in. minimum.

End of Section



Section 07 81 00  
APPLIED FIREPROOFING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of spray applied fireproofing where shown on the Drawings, as specified herein, and as required for a complete and proper installation.
- B. Furnish and install factory blended, spray applied cementitious fireproofing, at new structural steel elements.
- C. Patch existing fireproofing disturbed or otherwise damaged by the Work.

1.3 RELATED REQUIREMENTS

- A. Section 01 73 29 - CUTTING AND PATCHING: Procedural and administrative requirements for cutting and patching.
- B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- C. Section 05 12 00 - STRUCTURAL STEEL FRAMING.
- D. Section 05 21 00 - STEEL JOIST FRAMING.
- E. Section 05 31 00 - STEEL DECKING.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
  - 1. ASTM E 84 - Test for Surface Burning Characteristics of Building Materials.
  - 2. ASTM E 119 - Fire Tests of Building Construction and Materials.
  - 3. ASTM E 605 - Thickness and Density of Sprayed Fire-Resistive Material Applied to Structural Members.

4. ASTM E 736 - Cohesive Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
5. ASTM E 759 - Effect of Deflection of Sprayed Fire-Resistive Material Applied to Structural Members.
6. ASTM E 760 - Effect of Impact on Bonding of Sprayed Fire- Resistive Material Applied to Structural Members.
7. ASTM E 761 - Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.
8. ASTM E 859 -Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members.
9. ASTM E 937 - Corrosion of Steel by Sprayed Fire-Resistive Materials Applied to Structural Members.
10. ASTM G-21 - Determining Resistance of Synthetic Polymeric Materials to Fungi.
11. IAS AC291 – Accreditation Criteria for Special Inspection agencies.
12. UL - Fire Resistance Directory.
13. All applicable federal, state and municipal codes, laws and regulations for fire-resistant construction.

B. Definitions:

1. Structural Steel Elements: Structural building components scheduled to receive SFRM including: built-up trusses, steel decking, form decking, beams, columns, cross-braces, and related structural steel.
2. SFRM (Sprayed Fire-Resistant Materials) is spray-applied fireproofing as specified under this Section and defined under the International Building Code.

## 1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Owner, Architect, General Contractor, Fireproofing Applicator's Project Superintendent, Fireproofing manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor.
2. Agenda:
  - a. Scheduling of fireproofing operations.
  - b. Review of staging and material storage locations.

- c. Coordination of work by other trades.
  - d. Installation procedures for ancillary equipment.
  - e. Protection of completed Work.
  - f. Establish weather and working temperature conditions to which Architect and Contractor must agree.
  - g. Emergency rain protection procedure.
  - h. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.
- C. Sequencing:
- 1. Sequencing for application to steel decking:
    - a. Apply spray-applied fire resistive material to steel deck which has been fabricated and erected in accordance with the criteria set forth by the Steel Deck Institute. Refer to Structural Drawings and Specifications.
    - b. The application of spray-applied fire resistive material to the underside of roof deck shall not commence until the roof is completely installed and tight, all penthouses are complete, all mechanical units have been placed, and construction roof traffic has ceased.
      - 1) Fire protection shall not be applied to steel floor decks prior to the completion of concrete work on that deck.
      - 2) When occasional roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.
- D. Scheduling:
- 1. The installation of ducts, piping, conduit or other suspended equipment shall not take place until the application of sprayed fire protection is complete in an area.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
- 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and limitations of fireproofing.
  - 2. Shop Drawings: Provide floor plans indicating fireproofing locations, ratings required, and types of fireproofing at each location.
  - 3. Test and Evaluation Reports:
    - a. Bond strength of fireproofing: ASTM E 72, tested to provide minimum bond strength twenty times weight of fireproofing materials.
    - b. Fire test reports of fireproofing application to substrate materials similar to project conditions.
    - c. Reports from reputable independent testing agencies, of product proposed for use, which indicate conformance with ASTM E 119 and ASTM E 84
  - 4. Manufacturer's Instructions and typical details: Indicate special application procedures or conditions.

5. Qualifications Data: For installer and testing agency.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
    1. Certificates: Installers certificate stating that sprayed fireproofing has been completed in full accordance with requirements to provide necessary fire resistance ratings.
    2. Record Documentation: Installer's Field Reports stating environmental conditions during the installation of fireproofing materials, include temperature and humidity conditions.
    3. Bonds and Warranty Documentation:
      - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.
    4. Special Inspections: Submit prior to request for Certificate of Occupancy, to both Architect and local Building Official having jurisdiction, the following:
      - a. All certifications, reports and programs required by Chapter 17 of the Massachusetts State Building code for applied fireproofing work performed under the requirements of this Section.
- 1.7 QUALITY ASSURANCE
- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
  - B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of fireproofing.
  - C. Qualifications:
    1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
    2. Special Inspector of Sprayed Fire-Resistant Materials, Mastic and Intumescent Fire Resistant Coatings:
      - a. Special Inspector Agency: Independent third party hired directly by the Construction Manager.
      - b. Special Inspector Agency (company and Individual) Qualifications: Comply with IAS AC291, and having the competence necessary to inspect the work of this Section 07 81 00.
      - c. The Special Inspector (individual) shall have a valid and current ICC Spray-Applied Fireproofing Special Inspector Certificate, or ICC Fire Inspector 1 Certificate with not less than 1 year related experience.
- 1.8 MOCK-UPS
- A. Provide mock-up under provisions of Section 01 43 39 – MOCK-UPS.
  - B. Construct mockup as follows, conform to project requirements for fire ratings, thickness and density of application.

1. Apply a mock-up area consisting of a typical overhead fireproofing installation, including not less than 15 feet (4.5 m) of beam and deck.
  2. Apply second mock-up consisting of a typical column.
- C. Locate where directed by Architect. Schedule mock-up installation with Owner's Project Representative for observation.
- D. Examine installation within one hour of application to determine variance due to shrinkage, temperature and humidity.
1. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary then remove materials and reconstruct mockup.
- E. Accepted mockup may remain as part of the work.
1. Keep accepted mock-up installation open for observation as criteria for sprayed-on fireproofing work.
  2. Protect mock-up from damage until Project Substantial Completion.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  2. Deliver materials, factory proportioned and mixed, in original, unopened packages bearing the name of the product, manufacturer's name, plant identification, lot number and Underwriter's Laboratories, Inc. label.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  2. Store all materials in an elevated dry location, protected by waterproof coverings.
  3. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage.

#### 1.10 SITE CONDITIONS

- A. Do not apply spray fireproofing when ambient temperature or surface temperature of substrate material is below 40 degrees Fahrenheit.
- B. Provide ventilation in areas to receive fireproofing during and 24 hours after application, to cure fireproofing material.

#### 1.11 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.

- B. Special Warranty: Provide 2 year warranty or bond which shall include failure of fireproofing, including: cracking, checking, dusting, flaking, spalling, separation and blistering. Failure to provide such performance will require re-installation to repair to satisfaction of Owner at no additional cost.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Carboline, Fireproofing Products, St. Louis MO. ("Carboline")
  2. GCP Applied Industries, Cambridge, MA. ("GCP")
  3. Isolatek International, Inc. "CAFECO", Stanhope NJ.
  4. Southwest Fireproofing Products Co. (*Division of Carboline*), Albuquerque, NM ("Southwest").
  5. Vellrath Engineering, Pequabuck, CT.

### 2.2 DESCRIPTION

- A. General: Spray applied fireproofing, factory proportioned and mixed meeting the following requirements:
1. Sprayed fireproofing materials (SFRM) shall be free of all forms of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite. Material manufacturer shall provide certification of such upon request.
  2. Fireproofing materials shall not be subject to losses from finished application by sifting, flaking or dusting.
  3. Fireproofing shall not deform more than 10 percent under 500 pound per square foot compressive forces in accordance with ASTM E 761.
  4. Bare, shop-coated, and galvanized steel sheets with the fireproofing applied shall be kept at 90 degrees Fahrenheit and 70 percent relative humidity for 240 hours without evidence of corrosion of steel, tested in accordance with ASTM E 937.
  5. Corrosion Resistance: When tested in accordance with ASTM E937, the material shall not promote corrosion of steel.
  6. Combustibility: Fireproofing material shall have a maximum total heat release of 20 MJ/m<sup>2</sup> and a maximum 125 kw/m<sup>22</sup> peak rate of heat release 600 seconds after insertion when tested in accordance with ASTM E1354 at a radiant heat flux of 75 kw/m<sup>2</sup> with the use of electric spark ignition. The sample shall be tested in the horizontal orientation.
  7. Surface Burning Characteristics: When tested in accordance with ASTM E84, the material shall exhibit the following surface burning characteristics:
    - a. Flame Spread 10
    - b. Smoke Developed 0
- B. Regulatory Requirements:

1. Provide under Section 01 45 29 - TESTING LABORATORY SERVICES: Certification by an independent testing laboratory acceptable to the Owner, that materials, dry densities, thickness, and application procedures satisfy the requirements of the governing laws, building code, and UL requirements, with respect to the minimum protection requirements specified herein when tested in accordance with ASTM E 119.

## 2.3 PERFORMANCE/DESIGN CRITERIA

- A. Materials, procedures for application, dry densities, and thicknesses necessary to provide the required protection shall be tested and rated by UL in accordance with the procedures of UL 263 (ASTM E119) for the uses indicated
- B. The UL listing for each fire rated assembly must state that the superimposed load used in the test was determined by Allowable Stress Design Method or Load and Resistance Factor Design Method. UL listings with a Load Restriction are not allowed.
- C. Fire ratings interpolated or extrapolated from actual test data will not be acceptable. Provide evidence prior to application that proposed materials, installation methods and materials have been approved by all authorities having jurisdiction.
- D. Thickness and density: Thickness and dry density of fire protection material shall be according to the manufacturer's data and UL requirements to provide the following fire resistance ratings.
  1. Steel columns: 2 hour fire resistance rating.
  2. Primary steel members, including: trusses, girders, and beams: 2 hour fire resistance rating.
  3. Floor decks: 1 hour or 2 hour fire resistance rating (depending on location, refer to Drawings)
- E. Thickness and density of patching: Thickness and dry density of fire protection material shall be according to the manufacturer's data and UL requirements to provide ratings matching original building fire resistant requirements.

## 2.4 SPRAY APPLIED FIREPROOFING

- A. Spray applied fireproofing Type A – "Light Density": For structural steel elements including: built-up trusses, steel deck, beams, and columns, and all other concealed applications except as otherwise indicated on the drawings, or as otherwise specified herein:
  1. Acceptable products:
    - a. Carboline, product: "Pyrolite 15HY".
    - b. GCP, product: "Monokote Type MK-6".
    - c. Isolatak International, product: "Cafco 300".
    - d. Southwest, product: "5GP".
  2. Performance Criteria:

Property	Test Method	Test value/results
Compressive Strength	ASTM E 761	3.5 lb/in <sup>2</sup> , minimum

- |               |            |   |
|---------------|------------|---|
| Bond Strength | ASTM E 736 | 200 lb/ft <sup>2</sup> , minimum        |
| Air Erosion   | ASTM E 859 | 3.5 grams/ft <sup>2</sup> , maximum     |
| Deflection    | ASTM E 759 | No evidence of cracking or delamination |
| Bond Impact   | ASTM E 760 | No evidence of cracking or delamination |
| Dry Density   | ASTM E 605 | 14 lb/ft, minimum                       |
3. Deflection: When tested in accordance with ASTM E759, the material shall not crack or delaminate when the non-concrete topped galvanized deck to which it is applied is subjected to a one time vertical center load resulting in a downward deflection of 1/120th of the span.
  4. Bond Impact: When tested in accordance with ASTM E760, the material shall not crack or delaminate from the concrete topped galvanized deck to which it is applied.
  5. Cohesion/Adhesion (bond strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have a minimum bond strength of 150 psf (pounds per square foot) [667N].
  6. Air Erosion: When tested in accordance with ASTM E859, the material shall not be subject to losses from the finished application greater than 0.025 grams per sq. ft.
  7. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 750 psf (pounds per square foot).
  8. Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL design, or as required by the Authority having jurisdiction, or shall have a minimum average density of 15 pcf (pounds per cubic foot).
  9. Resistance to Mold: Formulate the fireproofing material at the time of manufacturing with a mold inhibitor.
    - a. Test fireproofing material per ASTM G-21 and show resistance to mold growth for a period of 21 days for general use and 60 days for materials installed in plenums.
      - 1) Tested fireproofing material shall demonstrate resistance to mold growth when inoculated with aspergillus niger.
  10. The material shall have been tested and reported by Underwriters Laboratories, Inc. (UL) in accordance with the procedures of UL 263 (ASTM E119).
- B. Spray applied fireproofing Type B – “Medium Density”: Steel columns, steel framing and steel decking exposed within elevator shafts, and at all non-concealed (exposed to view) conditions:
1. Acceptable products:
    - a. Carboline, product: “Pyrolite 22”.
    - b. GCP, product: “Monokote Type Z-106”.
    - c. Isolatek International, product: “Cafco 400”.
    - d. Southwest, product: “7GP”.



2. Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL/UC design or as required by the authority having jurisdiction, or shall have a minimum average of 22 pcf (pounds per cubic foot).
  3. Cohesion/Adhesion (bond strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have a minimum bond strength of 430 psf (pounds per square foot) [1913N].
  4. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 7,344 psf (pounds per square foot).
- C. Spray applied fireproofing Type C – “High Density”: For structural steel elements adjacent to louvers, exterior screens, and where exposed to weather.
1. Acceptable products:
    - a. Southwest, product: “7HD”.
    - b. Carbolite, product: “Pyrocrete 40”.
    - c. GCP, product: “Monokote Type Z-146”.
    - d. Isolatek International, product: “Fendolite M-II”.
  2. Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL/ULC design or as required by the Authority having jurisdiction, or shall have a minimum average of 39 pcf.
  3. Cohesion/Adhesion (bond strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have an average bond strength of 1,000 psf (pounds per square foot) [4448N]
  4. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 43,200 psf (pounds per square foot).

## 2.5 HAND-PATCH FIREPROOFING

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Vellrath Engineering, Pequabuck, CT., product “Universal Fireproofing Patch”.
1. Acceptable Alternative Products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    - a. Vellrath: product “Universal Fireproofing Patch”.
      - 1) Maximum patch area limit: 432 square inches.
    - b. Southwest: product: Same as spray-fireproofing used, batch mixed for hand-patching application.
      - 1) Maximum patch area limit: 144 square inches.
    - c. GCP: product: “Monokote MK”
      - 1) Maximum patch area limit: 144 square inches.
    - d. CAFCO: product: “Caeco Fiber-Patch”
      - 1) Maximum patch area limit: 432 square inches.

- e. Southwest: product: Same as spray-fireproofing used, batch mixed for hand-patching application.
  - 1) Maximum patch area limit: 144 square inches.

B. Performance Criteria:

1. Performance Criteria:

Property	Test Method	Test value/results
Dry Density	ASTM E 605	38 lb/ft, minimum
Adhesion Strength	ASTM E 736	2745 lb/ft <sup>2</sup> , minimum

2.6 ACCESSORIES

- A. Potable water shall be used for the application of sprayed fireproofing materials.
- B. Adhesive:
  - 1. Bonding adhesive for fibrous materials as recommended and supplied by the fireproofing material manufacturer. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.
- C. Sealer:
  - 1. Carboline, product: "Carboguard 1390".
  - 2. GCP, product: "Firebond Concentrate".
  - 3. Isolatek International, product: "Bond-Seal".
  - 4. Southwest, product as recommended by manufacturer.
- D. Mold Inhibitor: Mold inhibitor shall be added to fireproofing materials in accordance with manufacturer's instructions.

**PART 3 - EXECUTION**

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Inspect all surfaces and verify that they are in proper acceptance of existing substrate and site conditions.
    - a. Contact fireproofing manufacturer for procedures on handling primed / painted steel.
    - b. Ensure clips, hangers, supports, sleeves and other attachments to the substrate are placed by others prior to the application of spray-applied fire resistive materials.
  - 2. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

- A. Close and seal ductwork in areas where fireproofing is being applied.
- B. Provide temporary enclosures to prevent spray from contaminating air.

- C. Protection of In-situ Conditions: Protect adjacent surfaces and equipment from damage by overspray and dusting. Mask adjacent work as required. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- D. Surface Preparation:
  - 1. Clean substrate of dirt, dust, grease, oil, loose material, or other matter which may effect bond of fireproofing.
  - 2. Remove incompatible materials which affect bond by scraping, brushing, scrubbing, or sandblasting. Repair or replace any work so damaged and soiled.

### 3.3 MIXING AND APPLICATION

- A. Mixing shall conform to manufacturer's written instructions.
- B. Materials and equipment shall be as approved by the materials manufacturer. Application shall be by licensed manufacturer's applicators. Procedures shall be in strict accordance with said manufacturer's directions and specifications. Only experienced, skilled mechanics approved by the materials manufacturer shall be allowed to place the materials. A qualified manufacturers representative shall be present for initial application to guide and assist applicator's personnel.
- C. Work shall comply with applicable UL standards in addition to the requirements imposed by the applicable laws and codes, for the indicated ratings, including local pollution control regulations.
- D. Sprayed-on fireproofing shall be applied in the exact manner described in the certificates submitted to prove compliance with specified protection requirements. The fireproofing applicator shall be responsible for providing a controlled application of fireproofing material so that uniform quantity and thickness is maintained.
- E. After completion of fireproofing work, equipment shall be removed and all surrounding wall and floor areas cleaned of deposits of sprayed-on fireproofing materials. Where hangers and other surfaces not requiring fireproofing have been sprayed unavoidably, the sprayed material shall be removed and the surfaces made clean.

### 3.4 REPAIR

- A. Patch all areas of testing and any area where fireproofing has been damaged or removed during construction.

### 3.5 FIELD QUALITY CONTROL

- A. Independent Testing Agency field inspection (Special Inspections) will be performed under the provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Independent Testing Agency field inspection (Special Inspections) will be performed under the provisions of Section 01 45 29 - TESTING LABORATORY SERVICES.

- C. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
  - 1. Prior to fireproofing application, verify surface preparation is in accordance with the written instructions of the approved manufacturer.
  - 2. Verify substrate temperature before and after application is in accordance with the written instructions of the approved manufacturer.
  - 3. Verify ventilation of area before and after application is in accordance with the written instructions of the approved manufacturer.
  - 4. Measure average thickness per ASTM E605 and International Building Code, Chapter 17.
  - 5. Determine density in accordance with ASTM E605 and International Building Code, Chapter 17.
  - 6. Determine cohesive/adhesive bond strength in accordance with ASTM E736 and International Building Code, Chapter 1.
    - a. Test bond strength to primed steel, painted steel and unpainted steel, as appropriate to project.
  - 7. Test for bond impact strength: ASTM E-760.
- D. Ensure that applied fireproofing remains exposed to view until verification inspections and testing is made and approval of applied fireproofing is obtain. All costs for removal and replacement of prematurely installed materials to allow inspection of fireproofing shall be borne by the Contractor.
- E. Fireproofing will be considered defective if it does not pass tests and inspections.
  - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
  - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- F. Inspection and testing shall verify that applied thickness and density meets manufacturer's tested requirement standards for required fire-resistance ratings.
  - 1. Where samples fail to meet thickness, quality, or dry density requirements, further sampling and testing will be required in the area of deficient sample. If such further testing indicates a deficient area, correction shall be made by the application of additional material or removal and replacement of faulty material.

### 3.6 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris. Place waste material in suitable bags or containers, and remove from site.
- B. Upon completion of the work of this Section in any given area, clean walls, floors (including bare concrete slabs) and surrounding surfaces of overspray and drippings. Remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

- C. Waste Management:
1. Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

End of Section

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Section 07 81 43

APPLIED INTUMESCENT IGNITION BARRIER

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. General: The work of this Section consists of applied intumescent ignition (thermal) barriers where shown on the Drawings, as specified herein, and as required for a complete and proper installation.
- B. Furnish and install the following:
  - 1. Applied intumescent non-prescriptive thermal barrier (equivalent thermal barrier) over spray foam plastics.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 07 21 31 - CLOSED CELL SPRAYED FOAM INSULATION.
- D. Section 07 21 00 - THERMAL INSULATION: Rigid foam insulation.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
  - 1. ASTM E 84 - Test for Surface Burning Characteristics of Building Materials.
  - 2. ASTM E 119 - Fire Tests of Building Construction and Materials.
  - 3. ASTM E 605 - Thickness and Density of Sprayed Fire-Resistive Material Applied to Structural Members.
  - 4. ASTM E 736 - Cohesive Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

5. ASTM E 759 - Effect of Deflection of Sprayed Fire-Resistive Material Applied to Structural Members.
6. ASTM E 760 - Effect of Impact on Bonding of Sprayed Fire- Resistive Material Applied to Structural Members.
7. ASTM E 761 - Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.
8. ASTM E 859 -Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members.
9. ASTM E 937 - Corrosion of Steel by Sprayed Fire-Resistive Materials Applied to Structural Members.
10. ASTM G-21 - Determining Resistance of Synthetic Polymeric Materials to Fungi.
11. UL - Fire Resistance Directory.
12. All applicable federal, state and municipal codes, laws and regulations for fire-resistant construction.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

##### B. Sequencing:

1. The installation of ducts, piping, conduit or other suspended equipment shall not take place until the application of sprayed fire protection is complete in an area.

#### 1.6 SUBMITTALS

##### A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and limitations of fireproofing.
2. Shop Drawings:
  - a. Manufacturer's typical details, indicate project specific special detailing.
  - b. Floor plans indicating all ignition barrier locations.
3. Test and Evaluation Reports:
  - a. Bond strength of fireproofing: ASTM E 72, tested to provide minimum bond strength twenty times weight of fireproofing materials.
  - b. Fire test reports of fireproofing application to substrate materials similar to project conditions.
  - c. Reports from reputable independent testing agencies, of product proposed for use, which indicate conformance with ASTM E 119 and ASTM E 84



4. Manufacturer's Instructions: Manufacturer's installation instructions and typical details. Indicate any special application procedures or conditions
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Bonds and Warranty Documentation:
    - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section, including coverage of materials and installation.
  2. Record Documentation:
    - a. Installers certificate stating that sprayed fireproofing has been completed in full accordance with requirements to provide necessary fire resistance ratings.
    - b. Installer's Field Reports stating environmental conditions during the installation of fireproofing materials, include temperature and humidity conditions.
- 1.7 QUALITY ASSURANCE
- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Qualifications:
1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.
- C. Certifications: Provide under Section 01 45 00 - QUALITY CONTROL: Certification by an independent testing laboratory acceptable to the Owner, that materials, dry densities, thickness, and application procedures satisfy the requirements of the governing laws, building code, and UL requirements, with respect to the minimum protection requirements specified herein when tested in accordance with ASTM E 119.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  2. Deliver materials, factory proportioned and mixed, in original, unopened packages bearing the name of the product, manufacturer's name, plant identification, lot number and Underwriter's Laboratories, Inc. label.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  2. Store all materials in an elevated dry location, protected by waterproof coverings.
  3. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

- C. Damaged material: Dispose of any materials which have been exposed to moisture. during shipping storage or handling.

#### 1.9 SITE CONDITIONS

- A. Do not apply spray fireproofing when ambient temperature or surface temperature of substrate material is below 40 degrees Fahrenheit.
- B. Provide ventilation in areas to receive fireproofing during and 24 hours after application, to cure fireproofing material.

#### 1.10 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manufacturer Warranty:
  - 1. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.
- C. Extended Correction Period: Provide applicators 2 year warranty or bond, which shall include failure of fireproofing, including: cracking, checking, dusting, flaking, spalling, separation and blistering. Failure to provide such performance will require re-installation to repair to satisfaction of Owner at no additional cost.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  - 1. BASF Polyurethane Foam Enterprises, LLC, Minneapolis, MN. (BASF)
  - 2. Bayer Material Science Bay Systems, Phoenix, AZ. (Bayer)
  - 3. Flame Seal Products, Inc., Houston, TX. (Flame Seal)
  - 4. GCP Applied Technologies, Cambridge MA. (GCP)
  - 5. International Fireproof Technology, Inc., Irvine CA. (IFTI)
  - 6. Isolatak International, Inc. "Cafco Brand", Stanhope NJ. (Cafco)
- B. Thermal barrier: Two-component, intumescent fireproofing material approved for use over spray polyurethane foam interior insulation applications as a non-prescriptive thermal barrier (equivalent thermal barrier).
  - 1. Acceptable products: Subject to compliance with the requirements specified herein and acceptance by the manufacturer of the primary insulation material, thermal barrier products include the following:

- a. BASF product "Spraycoat 1920".
- b. Bayer product "IC".
- c. Flame Seal, product "Flame Seal-TB".
- d. GCP. product: "Monokote Type Z-3306.
- e. IFTI product: "CD315."
- f. CAFCO, product "TB-415" or "TB-15".

## 2.2 PERFORMANCE/DESIGN CRITERIA

- A. Materials, procedures for application, dry densities, and thicknesses necessary to provide the required protection shall be tested and rated by UL in accordance with the procedures of UL 263 (ASTM E119) for the uses indicated
- B. Fire ratings interpolated or extrapolated from actual test data will not be acceptable. Provide evidence prior to application that proposed materials, installation methods and materials have been approved by all authorities having jurisdiction.

## 2.3 MATERIALS

- A. General: Spray applied fireproofing, factory proportioned and mixed meeting the following requirements:
  1. Sprayed fireproofing materials shall be free of all forms of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite. Material manufacturer shall provide certification of such upon request.
  2. Fireproofing materials shall not be subject to losses from finished application by sifting, flaking or dusting.
  3. Fireproofing shall not deform more than 10 percent under 500 pound per square foot compressive forces in accordance with ASTM E 761.
  4. Bare, shop-coated, and galvanized steel sheets with the fireproofing applied shall be kept at 90 degrees Fahrenheit and 70 percent relative humidity for 240 hours without evidence of corrosion of steel, tested in accordance with ASTM E 937.
  5. Corrosion Resistance: When tested in accordance with ASTM E937, the material shall not promote corrosion of steel.
  6. Noncombustibility: When tested, the material shall be noncombustible.
  7. Surface Burning Characteristics: When tested in accordance with ASTM E84, the material shall exhibit the following surface burning characteristics:
    - a. Flame Spread 10
    - b. Smoke Developed 0

- B. Spray applied fireproofing

1. Performance Criteria:

Property	Test Method	Test value/results
Compressive Strength	ASTM E 761	3.5 lb/in <sup>2</sup> , minimum
Bond Strength	ASTM E 736	200 lb/in <sup>2</sup> , minimum
Air Erosion	ASTM E 859	3.5 grams/ft <sup>2</sup> , maximum

- |             |            |   |
|-------------|------------|---|
| Deflection  | ASTM E 759 | No evidence of cracking or delamination |
| Bond Impact | ASTM E 760 | No evidence of cracking or delamination |
| Dry Density | ASTM E 605 | 14 lb/ft, minimum                       |
2. Deflection: When tested in accordance with ASTM E759, the material shall not crack or delaminate when the non-concrete topped galvanized deck to which it is applied is subjected to a one time vertical centerload resulting in a downward deflection of 1/120th of the span.
  3. Bond Impact: When tested in accordance with ASTM E760, the material shall not crack or delaminate from the concrete topped galvanized deck to which it is applied.
  4. Cohesion/Adhesion (bond strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have an average bond strength of 150 psf.
  5. Air Erosion: When tested in accordance with ASTM E859, the material shall not be subject to losses from the finished application greater than 0.025 grams per sq. ft.
  6. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 750 psf.
  7. Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL design, or as required by the Authority having jurisdiction, or shall have a minimum average density of 15 pcf.
  8. Resistance to Mold: Formulate the fireproofing material at the time of manufacturing with a mold inhibitor.
    - a. Test fireproofing material per ASTM G-21 and show resistance to mold growth for a period of 21 days for general use and 60 days for materials installed in plenums.
      - 1) Tested fireproofing material shall demonstrate resistance to mold growth when inoculated with aspergillus niger.
  9. The material shall have been tested and reported by Underwriters Laboratories, Inc. (UL) in accordance with the procedures of UL 263 (ASTM E119).

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  1. Beginning of installation means acceptance of existing substrate and project conditions.

#### 3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of

reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.

- B. Close and seal ductwork in areas where thermal barrier / fireproofing is being applied.
- C. Protect adjacent surfaces and equipment from damage by overspray and dusting. Mask adjacent work as required.
- D. Provide temporary enclosures to prevent spray from contaminating air.
- E. Clean substrate of dirt, dust, grease, oil, loose material, or other matter which may effect bond of fireproofing.
- F. Remove incompatible materials and contaminants which affect bond. Repair or replace any work so damaged and soiled.

### 3.3 MIXING AND APPLICATION

- A. Mixing shall conform to manufacturer's written instructions.
- B. Materials and equipment shall be as approved by the materials manufacturer. Application shall be by licensed manufacturer's applicators. Procedures shall be in strict accordance with said manufacturer's directions and specifications. Only experienced, skilled mechanics approved by the materials manufacturer shall be allowed to place the materials. A qualified manufacturers representative shall be present for initial application to guide and assist applicator's personnel.
- C. Work shall comply with applicable UL standards in addition to the requirements imposed by the applicable laws and codes, for the indicated ratings, including local pollution control regulations.
- D. Sprayed-on fireproofing shall be applied in the exact manner described in the certificates submitted to prove compliance with specified protection requirements. The fireproofing applicator shall be responsible for providing a controlled application of fireproofing material so that uniform quantity and thickness is maintained.
- E. After completion of fireproofing work, equipment shall be removed and all surrounding wall and floor areas cleaned of deposits of sprayed-on fireproofing materials. Where hangers and other surfaces not requiring fireproofing have been sprayed unavoidably, the sprayed material shall be removed and the surfaces made clean.

### 3.4 FIELD QUALITY CONTROL

- A. Independent Testing Agency field inspection will be performed under the provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Ensure that applied ignition barrier remains exposed to view until verification inspections and testing is made and approval of applied ignition barrier is obtained. All costs for removal and replacement of prematurely installed materials to allow inspection of ignition barrier shall be borne by the Contractor.

- C. Inspection and testing shall verify by pull tests confirming adhesion to spray foam substrate, and that applied thickness and density meets manufacturer's tested requirement standards for required to meet 15 minute ignition barrier resistance rating.
  - 1. Where samples fail to meet thickness, or adhesion requirements, further sampling and testing will be required in the area of deficient sample. If such further testing indicates a deficient area, correction shall be made by the application of additional material, or removal and replacement of faulty material if necessary.

### 3.5 PATCHING

- A. Patch all areas of testing and any area where thermal barrier has been damaged or removed during construction.

### 3.6 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris.
- B. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from overspray and drippings of thermal barrier installed under this Section.
- C. Clean work under provisions of Section 01 70 00 – EXECUTION.
- D. Waste Management:
  - 1. Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
  - 2. Dispose of liquid waste in accordance with all applicable regulations. Consult all regulations (federal, provincial, state, local) or a qualified waste disposal firm when characterizing waste for disposal. Contact manufacturer for MSDS sheets for product information, and recommendations for proposal disposal. Utilize licensed waste disposal companies as may be required, the following phone numbers for national companies are provided for the Contractor's convenience only.
    - a. Safety Kleen, Plano TX., (telephone 800-669-5740).
    - b. Clean Harbors, Norwell MA., (telephone 800-422-8998).
    - c. Phillip Services Corporation (PSC), Houston TX., (telephone 800-726-1300).

End of Section

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Section 07 84 00  
FIRESTOPPING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install fireproof firestopping, firesafing materials, smoke seals and related accessories required for this Project for all penetrations through fire resistance rated construction, including, but not limited to, penetrations for elevators, plumbing, fire suppression, heating, ventilating and air conditioning, electrical systems, and specialized equipment.
  - 1. Fire resistance rated construction requiring firestopping includes, but is not limited to: floors, rated partitions, smoke barriers, smoke partitions, partitions in rated corridors, passageways and stairs, shaft partitions, shaft wall (vertical and horizontal), area separation fire walls, party wall systems, and temporary fire resistant rated partitions and barriers.
  - 2. Provide removable temporary firestopping (pillows) as required to maintain fire integrity prior to Owner's final acceptance, to permit installation of electrical, telephone, data and sound system wiring. Replace temporary firestopping with permanent, after wiring systems are completed.
- B. Furnish and install firestopping/smoke seals at construction joints occurring at tops of fire resistance rated partitions, smoke partitions, and temporary partitions between top of partition and underside of deck above.
- C. Furnish and install all firestopping, firesafing, and smoke seals at perimeter of floor/roof construction and exterior wall systems, as indicated and where required by applicable codes.
- D. Furnish and install all firestopping, firesafing, and smoke seals at expansion joints in chase walls where expansion joints are not exposed to view.
- E. Firestop all existing penetrations and openings in fire resistant rated partitions and floor assemblies which are discovered during the work and are not currently firestopped, or are improperly firestopped.
- F. Furnish and install all firestopping, firesafing, and smoke seals where required by applicable codes and as additionally required by authorities having jurisdiction at no additional cost to the Owner.

### 1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 05 31 00 - STEEL DECKING: Metal floor and roof deck.
- D. Section 09 29 00 - GYPSUM BOARD: Gypsum wallboard fireproofing.
- E. Division 21 - FIRE SUPPRESSION: Fire protection system penetrations through fire resistance rated construction.
- F. Division 22 - PLUMBING: Plumbing system penetrations through fire resistance rated construction.
- G. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Heating, ventilating and air conditioning system penetrations through fire resistance rated construction.
- H. Division 26 - ELECTRICAL: Electrical penetrations through fire resistance rated construction.

### 1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
  - 2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
  - 3. ASTM E814 - Test Method of Fire Tests of Through-Penetration Firestops.
  - 4. ASTM E2174 - Standard Practice for On-site Inspection of Installed Fire Stops
  - 5. ASTM E2393 - Standard Practice for On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
  - 6. NFPA 70 - National Electrical Code.
  - 7. UL - Fire Resistance Directory.
  - 8. UL 1479 - Fire Tests of Through Penetration Firestops.

### 1.5 PERFORMANCE REQUIREMENTS

- A. Provide materials and work to conform to Building Code Requirements in fire resistant wall and floor assemblies.
- B. Manufacturer's certified product test requirements:
  - 1. All firestop/smokeseal material shall be tested by a recognized, independent testing agency and shall conform to both Flame (F-rating) and Temperature (T-rating) requirements of ASTM E-814.



2. Conform to UL Fire Hazard Classification Requirements.
  3. Tested and classified non-combustible per ASTM E-84.
- C. Firestops in place shall be of sufficient thickness, width, and density to provide a fire resistance rating at least equal to the floor, wall, or partition construction into which it is installed.
- D. Non-combustible dams shall be constructed:
1. As necessary to achieve fire rating as tested and rated.
  2. In conformance with installation requirements for type of floor, wall, and partition construction.
  3. As recommended by firestop/smokeseal manufacturer.
- E. Combustible damming materials, if used, must be removed after proper curing.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, and physical properties.
    - a. Indicate requirements for manufacturer's descriptive data for products and related materials with FM, UL or Warnock-Hersey illustrations showing systems and approval of materials in systems.
  2. Certificates: Manufacturer's written certification stating that firestopping materials, meet or exceed the requirements specified under this Section and that all fire-resistive requirements for the indicated combustibility, Flame (F-rating) and Temperature (T-rating) Ratings have been met.
  3. Manufacturer's installation instructions.
  4. Test reports: Submit fire test reports from recognized, independent testing agent(s) indicating the following:
    - a. Fire test report of firestop material applied to substrate and penetration materials similar to project conditions. Tests to indicate both Flame (F-rating) and Temperature (T-rating) Ratings.
    - b. Test reports of products to be used shall indicate conformance to ASTM E-814.
  5. On-site sample installation to be included in Work: Minimum thirty days prior to application in any area, provide samples of firestop and smoke seal materials and installation in accordance with the following requirements.
    - a. Apply one sample of appropriate firestop and smoke seal material for each different penetration and fire rating required for the work.
    - b. Sample areas will comply with thickness, fire resistance ratings, and finished appearance of the project and applicable fire code.
    - c. Acceptance samples will constitute standard of acceptance for method of application, thickness, and finished appearance for firestop and smoke seal application. The sample(s) shall remain visible during completion of the work and shall remain as part of the completed work.

6. Shop drawings indicating requirements for penetrations in wall/deck intersections, change of planes, control joints, expansion joints and blank openings.
7. LEED Submittal Requirements:
  - a. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
    - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
      - a) The exposure scenario used to determine compliance.
      - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
      - c) Laboratory accreditation under ISO/IEC 17025.
      - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
    - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
    - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
  - b. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
    - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
      - a) The exposure scenario used to determine compliance.
      - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
      - c) Laboratory accreditation under ISO/IEC 17025.
      - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
    - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
    - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.

#### 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

- B. Sole Source: Obtain firestop and smoke seal products from a single manufacturer, except as otherwise approved by Architect.
- C. Environmental Requirements for Volatile Chemicals: Use firestopping caulks that comply with the following limits for VOC content:
  - 1. Firestopping caulks: VOC not more than 250 g/L.
- D. Special Inspections: Allow for 3 percent of each type of firestopping system to be removed and inspected for conformance with approved submittals.
  - 1. firestopping shall be inspected prior to installation of suspended ceilings or concealed by other materials.
- E. Qualifications:
  - 1. Installer: a specialized subcontractor having not less than 3 years documented experience demonstrating previously successful work of the type specified herein.
    - a. The manufacturer of the firestop material shall submit written certification that the firm to be used for the firestop products has been trained in the application of the products by the manufacturer.
  - 2. Independent Third Party Firestopping Inspector: a specialized testing agency having not less than 5 years documented experience demonstrating previously successful work of the type specified herein.

#### 1.8 MOCK-UPS

- A. Provide mock-ups under provisions of Section 01 43 39 – MOCK-UPS for purpose of verifying quality of firestop installation.
- B. Provide firestop samples and locate as directed. Accepted samples may remain as part of the work.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store firestopping materials in original, sealed, packages showing manufacturer's identification and date of packaging.
- B. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following:
  - 1. Bio Fireshield (A Division of Rectro Seal), Houston TX.
  - 2. Dow Corning Corporation, Midland MI.
  - 3. Hilti, Inc. Tulsa OK.
  - 4. 3M Company, Saint Paul MN.
  - 5. Specified Technologies, Inc., Somerville NJ.

6. Metacaulk, (A Division of Rectroseal), Houston TX.
7. Tremco, Inc., Beachwood OH.

## 2.2 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire resistance ratings and surface burning characteristics.
- B. Obtain certificate of compliance from authority having jurisdiction indicating approval of combustibility.

## 2.3 MATERIALS

- A. Firestop mortar: asbestos free, cementitious mortar, U.L. classified as a "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM/UL1479.
  1. Acceptable products, or approved equal:
    - a. Bio Fireshield, product "Novasit K-10".
    - b. Hilti, Inc., product "CP 637 Firestop Mortar".
    - c. Specified Technologies, Inc., product "SSM Firestop Mortar".
    - d. Tremco Inc., product "Tremstop M".
- B. Firestop sealant: Single component, non-combustible firestop sealant, U.L. classified as a "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
  1. Acceptable products, or approved equal:
    - a. Bio Fireshield, product product "Biotherm 100" (Gun Grade) or "Biotherm 200" (Self Leveling).
    - b. Hilti, Inc., product "CFS-S SIL GG" (Gun Grade).
    - c. Specified Technologies, Inc., product "SpecSeal SIL300 Sealant (gun grade)" or "SpecSeal SIL300SL" (Self Leveling).
    - d. 3M Company, product "Fire Barrier Silicone Sealants".
    - e. Tremco Inc., product product "Tremsil" (Gun Grade) or "Tremsil S/L" (Self Leveling).
  2. Sealants will not dissolve in water.
- C. Intumescent firestop sealant and caulks: Acrylic based, water resistant sealant, which will not re-emulsify after drying.
  1. Acceptable products, or approved equal:
    - a. Bio Fireshield, product "Biostop 500".
    - b. Hilti, Inc., product "FS-ONE Intumescent Firestop Sealant" or "FS 657 Fireblock".
    - c. Specified Technologies, Inc., product "SpecSeal SSS".
    - d. 3M Company, product "Fire Barrier Caulk CP25WB+".
    - e. Tremco Inc., product "Tremstop 1A".
- D. Firestop putty: sticks or pads.

1. Acceptable products, or approved equal:
    - a. Bio Fireshield, product "Moldable Putty".
    - b. Hilti, Inc., product "CP 767 Speed Strips" or "CP 777 Speed Plugs".
    - c. Specified Technologies, Inc., product "SpecSeal Putty Bars and Pads".
    - d. 3M Company, product "Fire Barrier Moldable Putty".
    - e. Tremco Inc., product "Flowable Putty".
  
  - E. Firestop collars: Pre-manufactured fire protective pipe sleeve, UL classified as "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
    1. Provide separated (two piece) firestop collar for application when plastic pipe system is already in place. Provide non-separated firestop collar for application prior to installation of plastic pipe system.
    2. Acceptable products, or approved equal:
      - a. Bio Fireshield, product, product "Fireshield Pass-through Device", or "Biostop Intumescent Sleeve."
      - b. Hilti, Inc., product "CP 643 Firestop Collar".
      - c. Specified Technologies, Inc., product "SpecSeal Collars".
      - d. 3M Company, product "Fire Barrier PPD's".
      - e. Tremco Inc., product "Fyrecan sleeve".
  
  - F. Firestop pillows: UL Classified as "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
    1. Acceptable products, or approved equal:
      - a. Bio Fireshield, product "Fireshield Firestop Pillows".
      - b. Specified Technologies, Inc., product "SSB Firestop Pillows".
      - c. Tremco Inc., product "Tremstop P.S".
  
  - G. Wrap strips:
    1. Acceptable products, or approved equal:
      - a. Bio Fireshield, product "FS-195".
      - b. Hilti, Inc., product "CP 645-E Endless Wrap Strip, or CP 648-S Firestop Wrap Strip".
      - c. Specified Technologies, Inc., product "Spec Seal Wrap Strip".
      - d. 3M Company, product "Fire Barrier FS195 Wrap Strip".
      - e. Tremco Inc., product "Tremco W.S".
  
  - H. Mineral wool fiber / ceramic wool non-combustible insulation (fire safing):  
Conforming to ASTM C665, Type 1, ASTM C612, and ASTM C553 with a minimum density of 4 pounds per cubic foot.
    1. Flame Spread Classification: Material shall be classified non-combustible per ASTM E-814.
    2. Recycled content of slag:: Use maximum available percentage of material (slag). Mineral wool insulation products incorporated into the work shall contain not less than 75 percent of recycled material (slag) by weight.
-

3. Acceptable products include:
    - a. Fibrex Insulations Inc. Sarnia Ontario, Canada, product: "Fibrex FBX" Industrial board.
    - b. Rock Wool Manufacturing Company, Leeds, AL, product: "Delta Safing Mineral Wool".
    - c. Roxul, Inc., product "Roxul Safe".
    - d. Thermafiber, Inc. product "Safing 4.0 pcf".
  4. Accessories: Provide galvanized steel safing clips as required for installation of insulation.
- I. Elastomeric Firestopping: Non halogenated latex based elastomeric coating applied by airless spray.
    1. Acceptable products, or approved equal:
      - a. Bio Fireshield (A Division of Retroseal), product "Biostop 750."
      - b. Hilti, Inc., product "CP 601S." or "CFS-SP-WB"
      - c. Specified Technologies, Inc., product "Spec Seal Elastomeric Firestop Spray".

## 2.4 ACCESSORIES

- A. Forming and damming materials: Mineral fiberboard or other type as recommended by firestopping manufacturer.
- B. Primer, sealant and solvents: As recommended by manufacturer.
- C. Woven wire mesh: Galvanized 20 gage woven wire mesh "chicken wire" or "poultry fencing", 1 inch spacing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
  1. Beginning of installation means acceptance of existing substrate and project conditions.

### 3.2 PREPARATION

- A. Surface to receive firestops shall be free of dirt, dust, grease, oil, form release agents, or other matter that would impair the bond of the firestop material to the substrate or penetrating item(s).
- B. Voids and cracks in substrate shall be filled and unnecessary projection removed prior to installation of firestops.
- C. All penetrating items shall be permanently installed prior to firestop installation.
- D. Substrate shall be frost, free and, when applicable, dry.

### 3.3 INSTALLATION

#### A. General

1. Installation of firestops shall be performed by applicators/installers qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations. Meet building code requirements.
3. Coordinate with plumbing, mechanical, electrical, and other trades to assure that all pipe, conduit, cable, and other items which penetrate fire rated construction have been permanently installed prior to installation of firestops. Schedule and sequence the work to assure that partitions and other construction which would conceal penetrations are not erected prior to the installation of firestops.
  - a. Ensure that all firestopping is inspected prior to installation of suspended ceilings or concealed by other finished materials.

#### B. Dam construction

1. Install dams when required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Combustible damming material must be removed after appropriate curing. Incombustible damming material may be left as a permanent component of the firestop system.
2. Placement of dams shall not interfere with function or adversely affect the appearance of adjacent construction.

#### C. Installation of single component silicone firestop

1. Apply with manual or powered caulking gun.
2. Apply minimum 1/2 inch thickness for 2 hour rating. Apply 1/2 inch to both sides of wall penetrations; one side only in floor penetrations.
3. Use incombustible insulation as required to achieve fire resistance rating.
4. Surface of gun grade silicone firestop may be tooled using clean, potable water.
5. Clean excess material off of adjacent surfaces and tools within 10 minutes using either water or Xylol where the use of such would not be hazardous.

#### D. Installation of cementitious firestop mortar.

1. Add dry powder to water and mix with mechanical mixer or hand mixing tools as recommended by firestop mortar manufacturer. Allow a average mixing time is 3 minutes and provide a average wet density of 70 pounds per cubic foot, plus or minus 5 PCF.
2. Do not apply if ambient or substrate temperature is less than 35 degrees Fahrenheit during 24 hours after application.
3. Wet all surfaces prior to application of firestop mortar.
4. Mortar may be hand applied or pumped into the opening.
5. Exposed surfaces shall be finished using conventional plastering tools prior to curing.

6. When installation around layered cables, it is recommended to increase the fluidity of the firestop mortar to provide a better fill around the cables. Vibrate or move the cables slightly to prevent voids from forming between the cables.
  7. Allow 48 hours for initial cure prior to form removal. For full cure allow 27 days.
  8. Wet material may be cleaned with water. Dry material may require scraping or chipping.
- E. Installation of firestop collars (plastic pipe only)
1. Firestop collars may be surface mounted to a slab or wall or imbedded in Firestop Mortar to a maximum depth of 2 inches.
  2. For wall penetrations with ABS pipe firestop collars must be installed on both sides of the penetration to provide a 2 hour F and T Rating. All other applications required installation on one side only to provide a 2 hour F and T Rating.
- F. Firesafing insulation: Install firestopping safing insulation on safing clips spaced as needed between each stud and floor slab, leaving no voids. Secure safing clips to slab using fasteners recommended by insulation manufacturer. Install sealant over mineral wool in accordance with test requirements.

#### 3.4 LABELING

- A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems.
1. Include the following information on labels

**WARNING: THROUGH-PENETRATION FIRESTOP SYSTEM-DO NOT DISTURB.  
NOTIFY FACILITY MANAGER OF ANY DAMAGE.**

- Contractor's name, address, and phone number.
- Through-penetration firestop systems designation of applicable testing and inspecting agency.
- Date of installation.
- Through-penetration firestop systems manufacturer's name.
- Installer's name.

#### 3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.
1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.
- B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.
- C. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.



### 3.6 SCHEDULE

- A. General: Typical penetrations are indicated below with list of standard firestopping/smokeseal approaches. Actual firestopping materials and combination of materials will vary with size of penetration and with individual firestopping manufacturer's approved UL Design System Requirements. Use only UL Design System materials for each penetration that best matches the wall and floor construction.
  - 1. Where penetrations occur for which no listed UL or WH Design System test exists, obtain from the firestop system manufacturer an engineered system acceptable to the authorities having jurisdiction for firestopping such penetrations. Engineered system from manufacturer shall include a detail drawing showing the engineered system and shall contain no disclaimers.
- B. Single metal pipe (non-insulated) and conduit penetrations through floors:
  - 1. Firestop mortar.
  - 2. Silicone Firestop sealant.
  - 3. Intumescent firestop sealant.
  - 4. Firestop putty, sticks or pads.
  - 5. Mineral fiber / ceramic wool non-combustible insulation (fire safing) in conjunction with a firestop sealant.
- C. Single metal pipe (non-insulated) and conduit penetrations through walls:
  - 1. (masonry and concrete walls only) Firestop mortar and putty.
  - 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
  - 3. Intumescent firestop sealant with wrap strips.
- D. Multiple metal pipe and conduit penetrations through floors:
  - 1. Firestop mortar and wrap strips.
  - 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- E. Multiple metal pipe and conduit penetrations through walls:
  - 1. Firestop mortar and putty.
  - 2. (through masonry walls only) Firestop pillows with woven wire mesh.
  - 3. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- F. Insulated metal pipe penetrations through floors:
  - 1. Firestop mortar and wrap strips.
  - 2. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
  - 3. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
  - 4. Silicone Firestop sealant over wrap strip.
  - 5. Mineral fiber / ceramic wool non-combustible insulation (fire safing) in conjunction with a firestop sealant.
- G. Insulated metal pipe penetrations (single and multiple) through walls:
  - 1. Firestop mortar with wrap strips.
  - 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).

3. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) and Wrap strips.
  4. (multiple penetrations through masonry walls only) Firestop pillows with woven wire mesh.
- H. Duct penetrations through floors or walls:
1. Rectangular and square ducts: Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing), and steel flanges provided under Division 15.
  2. Round ducts: Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- I. Combustible plastic pipe and conduit penetrations through floors:
1. Firestop mortar with wrap strips.
  2. Firestop mortar with firestop putty and firestop collars.
  3. Silicone firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
  4. Silicone firestop sealant and firestop collars.
  5. Intumescent firestop sealant and firestop collars.
  6. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) with firestop collars.
  7. (maximum pipe size 2 inches) Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) with wrap strips.
- J. Combustible plastic pipe and conduit penetrations through walls:
1. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
  2. Intumescent firestop sealant with firestop collars.
- K. Cable penetrations through floors:
1. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
  2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- L. Cable penetrations through walls:
1. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
  2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
  3. (single penetrations only) Firestop putty.
  4. (electrical boxes) Firestop pads.
  5. Firestop putty over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- M. Cable tray penetrations:
1. (floors only) Firestop mortar.
  2. Firestop pillows with woven wire mesh containment, and Firestop putty, sticks or pads for filling voids.
  3. Firestop pillows with woven wire mesh containment, and Firestop mortar at perimeter and firestop putty, sticks or pads for filling voids.
- N. Bus ducts through floors:
1. Firestop mortar and wrap strips.

2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) and 28 gage (minimum) steel cover plate.
- O. Blank openings:
1. Firestop mortar.
  2. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- P. Fire rated joints:
1. Silicone Firestop sealant over backer rod or bond breaker.
- Q. Construction joints at head of wall/floor assemblies:
1. Silicone Firestop sealant/mastic over mineral fiber / ceramic wool non-combustible insulation (fire safing).
  2. Elastomeric spray over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- R. Smoke barrier sealant for dampers, fire door frames:
1. Silicone Firestop sealant.
- S. Temporary sealing of openings and penetrations:
1. Firestop putty, sticks or pads.
  2. Firestop pillows.

End of Section

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Section 07 90 01  
SEALANT JOINTS - SITE

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. Requirements set forth herein are in addition to and shall be considered as complementary to the Terms and Conditions for Construction and the balance of Divisions 00 and 01 and Technical Specifications.
- B. All Contractors, Subcontractors, Vendors and the like shall be required to familiarize themselves with said provisions.

1.2 SUMMARY

- A. The work of this Section consists of providing all labor, equipment, materials and incidental work for the complete execution of all caulking and sealing work for this project as required by the schedules, keynotes and drawings, including, but not limited to the following:
  - 1. Provide sealant systems in all joints between dissimilar materials on the site as indicated and/or required to obtain water and air tight seals.
  - 2. Provide horizontal sealing systems in connection with monolithic and/or unit pavers to vertical surfaces; railing sets and the like; coordinate with applicable work in Division 32.
  - 3. Coordinate with Section 323000 for filling of top 1/2 inch of "sleeves" and/or "cores" retaining railing systems with Type IA material.
  - 4. Perform balance of caulking and sealing as may be necessary and/or required to insure conformance to guarantee/warranty provisions contained herein.

1.3 RELATED WORK UNDER OTHER SECTIONS

- A. The following sections include work related to this Section:
  - 1. 033001 Cast in Place Concrete - Site
  - 2. 042500 Stone Unit Masonry
  - 3. 055200 Miscellaneous Site Metal Fabrications
  - 4. 321440 Stone Unit Paving Mud Set
  - 5. 321313 Reinforced Concrete Pavement
  - 6. 323000 Site Furnishings

1.4 REFERENCES

- A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
  - 1. Reference Standards
    - a. ASTM C 834 Latex Sealing Compounds

- b. ASTM C 919 Standard Practice for Use of Sealants in Acoustical Applications.
  - c. ASTM C 920 Elastomeric Joint Sealants.
  - d. ASTM C 1193 Standard Guide for Use of Joint Sealants.
  - e. ASTM C 1311 Solvent Release Sealants.
  - f. ASTM C 1330 Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
  - g. ASTM C 1401 Standard Guide for Structural Sealant Glazing
  - h. ASTM C 1481 Standard Guide for Use of Joint Sealants with Exterior Insulation and Finish Systems (EFIS)
  - i. ASTM D 1056 Flexible Cellular Materials, Sponge or Expanded Rubber.
2. SWRI (Sealant, Waterproofing and Restoration Institute) Sealant and Caulking Guide Specification.

#### 1.5 QUALITY ASSURANCE

- A. The work of this Section shall be performed by a "Specialty Subcontractor" as defined in the Conditions.
- B. Bond testing shall be performed and results submitted to Owner's Representative for file.
- C. All surfaces to receive sealant shall be dry and cleaned of all foreign matter as specified in Part 3.
- D. Application devices shall have nozzles of proper size and shall provide sufficient pressure to completely fill joints as detailed.
- E. Consult sealant manufacturer for recommendations for application of sealant when air temperature is below 40°F. Provide written recommendation to Owner's Representative prior to application.

#### 1.6 SUBMITTALS

- A. GENERAL:
  - 1. Submittals shall be made in groupings where installations are complementary, i.e. steel, steel decking, steel stairs, stair railings; roof systems/flashings; mechanical and electrical apparatus and the like. Failure to comply with this requirement will be cause for rejection of any or all submittals.
  - 2. Prepare and submit a fully developed submittal schedule; note review times set forth in Section 013300 are deemed "average", for large submissions allow longer review times.
- B. Product Data indicating for each type of sealant and component used in this work - chemical characteristics; performance criteria; substrate preparation; limitations; color availability; and the like affecting the use of each product.
- C. Samples of all components to be used in the work of this section.

- D. Color charts for selection.
- E. Manufacturer's installation instructions indicating, if any, special procedures; surface preparation; perimeter conditions requiring special attention; and like items affecting installation of each product
- F. Results of bond tests shall be incorporated in installation recommendations.
- G. Certification of specification compliance.
- H. Manufacturers Material Safety Data Sheet (MSDS) must be submitted for each manufactured product.

#### 1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver products in original factory packaging bearing identification of product, manufacturer, and batch number. Provide Safety Data Sheets for each product.
- B. Store products in a location protected from freezing, damage, construction activity, precipitation, and direct sunlight in strict accordance with manufacturer's recommendations.
- C. Condition products to approximately 60 to 70 degrees F for use in accordance with manufacturer's recommendations.
- D. Handle all products with appropriate precautions and care as stated on Material Safety Data Sheet.

#### 1.8 QUALITY CONTROL

- A. Preconstruction Sealant Tests for Adhesion and Compatibility: Submit sealant samples for each material to be sealed in the work including, but not limited to metal flashing, masonry and stone of each type used, and all other components and accessories, to sealant manufacturer to verify sealant compatibility and to determine, by testing in compliance with ASTM C 794, as well as the type of primer required for each condition to ensure sealant adhesion to substrates.
  - 1. Cost of Testing: The sealant manufacturers shall perform and/or the Contractor shall, at his own expense employ an independent testing agent acceptable to the Owner's Representative to perform tests and certifications indicated. No costs shall be passed to the Owner.
  - 2. Test Samples: Submit to the testing agency or sealant manufacturer at least 5 pieces of each type, finish, kind, condition, and form of material to which sealant is to be attached.
  - 3. Scheduling: Scheduling sufficient time for testing, analysis, and reporting of results.
  - 4. Test Reports and Recommendations: Obtain written reports and recommendations regarding proper sealant material, primer, and application for each condition. Use sealants and substrates only in combinations for which favorable adhesion and compatibility results have been obtained.

- B. Construction Sealant Adhesion Tests shall be performed as specified under "Field Quality Control" in Part 3 of this Section.

#### 1.9 MOCKUP REQUIREMENTS

- A. Coordinate with mockup requirements in respective Division 03, 04, 05, 06,12 and 32 Sections as applicable.
- B. Construct, in consort with other elements of the work, a sample mockup (s) of joint sealant surrounds; expansion/control joint sealant system and such other work, both interior and exterior as required by the Owner's Representative.
- C. Mockups shall show sealant types, colors and tooled (finished) surfaces; allow for 2 colors per building material selection.
- D. Where practical, mockups shall remain as part of the finished work.

#### 1.10 SPECIAL GUARANTY/WARRANTY TERMS

- A. This Contractor shall, and hereby does warrant; and the Contractor shall, and hereby does guarantee that caulking and sealing work will be free from defects of materials and workmanship for 2 years from the date of final acceptance of this work.
- B. The following types of failure will be adjudged defective work: leakage, hardening, chalking, crumbling, melting, shrinking or running of caulking; or staining of adjacent work by caulking.
- C. Repair and replace work which becomes defective during the guarantee term, without cost to the Owner.

#### 1.11 SUSTAINABILITY

- A. In the selection of the products and materials of this section as well as for the entire project, preference will be given to those with the following characteristics:
  - 1. Water based.
  - 2. Water-soluble.
  - 3. Can be cleaned up with water.
  - 4. Non-flammable.
  - 5. Biodegradable.
  - 6. Low or preferably no Volatile Organic Compound (VOC) content.
  - 7. Manufactured without compounds that contribute to ozone depletion in the upper atmosphere.
  - 8. Manufactured without compounds that contribute to smog in the lower atmosphere.
  - 9. Do not contain methylene-chloride.
  - 10. Do not contain chlorinated hydrocarbons.
  - 11. Contains the least possible of post-consumer or postindustrial waste.

## PART 2 - PRODUCTS

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2.1 GENERAL

- A. Joint primer, sealer and/or conditioner shall be as recommended by the sealant manufacturer.
- B. Preformed joint fillers shall be non-staining compatible with sealant and primer, and of a resilient nature.
- C. Backer Rod for General Vertical Use: ASTM C 1330, Types B or C, rod stock closed cell polyethylene foam, closed cell neoprene foam, or open cell urethane foam, as recommended by sealant manufacturer as being compatible both with the sealant used and the primer.
- D. Accessory Items:
  - 1. Bond Breaker Tape - Polyethylene or other plastic tape as recommended by the sealant manufacturer; non-bonding to sealant; self-adhesive where applicable; thickness, minimum 0.012 inch.
  - 2. Cleaning Solvents - Oil free solvents as recommended by the sealant manufacturer. Do not use reclaimed solvents.
  - 3. Masking Tape - Removable paper or fiber tape, self-adhesive, non-staining.
  - 4. Materials impregnated with oil, bitumen or similar materials shall not be used.
- E. Sealant Colors
- F. Exposed materials, provide color as indicated or, if not indicated, as selected by the Owner's Representative from manufacturer's standard colors.
- G. Concealed materials, provide the natural color which has the best overall performance characteristics.

2.2 MATERIAL TABLE

- A. Sealant materials shall be as follows and shall relate to scope of work described herein and shall form a general material reference for all sections performing sealant operations. Backer systems shall be as specified in Paragraph 2.1 above and as suitable for intended substrate and joint conditions.
- B. Type - I (For use in vertical expansion joints where extensive movement occurs and for general exterior sealant operations.)
  - 1. Sealant compound - 2 component non-sag Polyurethane similar and equal to
    - a. Tremco (Dymeric 240FC or Dymonic FC)
    - b. BASF Building Products (Sonolastic NP2)
    - c. Pecora (Dynatrol II)
- C. Type - IA (For use with pavements, walks, curbs, plaza decks and other such locations)

1. Sealant compound - 2 component self-leveling polyurethane material similar and equal to
  - a. BASF Building Products (Sonolastic SL2 Horizontal)
  - b. Pecora (Urexpan NR-200 Horizontal/Dynatred Vertical)
  - c. Tremco (THC 900/901)
- D. Type - II - (For use in vertical expansion joints where extensive movement occurs and for general exterior sealant operations.)
  1. Sealant compound - 1 part, low-modulus silicone sealant similar and equal to
    - a. Dow Corning (795)
    - b. General Electric (Silpruf)
    - c. Pecora (864)
    4. BASF Building Products (Omniseal)
    - d. Tremco (Spectrem 1 or 2 as suitable for intended application)
  2. Backing - Type "A" backer rod as per Paragraph 2.1.C above for general use and Type III sealant for moving joints.

### **PART 3 - EXECUTION**

#### **3.1 INSPECTION AND ACCEPTANCE**

- A. Examine all surfaces and contiguous elements to receive work of this section and correct, as part of the Work of this Contract, any defects affecting installation. Commencement of work will be construed as complete acceptability of surfaces and contiguous elements.

#### **3.2 JOINT DESIGN**

- A. Joints shall be a maximum of 3/8 inch deep by minimum 3/8 inch wide.
- B. Joints in concrete or masonry:
  1. Depth of sealant shall equal width of joints in joints up to 1/2 inch wide; joints 1/2 inch to 1 inch wide, depth shall be 1/2 inch.
  2. For expansion joints or other joints 1 inch to 2 inch wide depth shall not be greater than 1/2 the applied sealant width and no greater than 5/8 inch for Type I nor 1/2 inch for Type II materials.
- C. Joints in metal, glass and other non-porous surfaces: Depth shall be a minimum of 1/2 the applied sealant width, and shall in no case exceed the applied sealant width.

#### **3.3 PREPARATION**

- A. Clean joint surfaces immediately before installation of sealant and other materials specified in this Section.
  1. Remove all loose materials, dirt, dust, rust, oils and other foreign matter that will impair the performance of materials installed under this Section.

2. Remove lacquers, protective coatings and similar materials from joint faces with manufacturer's recommended solvents.
3. Do not limit cleaning of joint surfaces to solvent wiping; use methods such as grinding, etching or other approved and manufacturer's recommended means, if required, to clean the joint surfaces, assuring that the sealant materials will obtain positive and permanent adhesion.

B. For Pavements, Walks, and Curbs

1. Set joint fillers at proper depth and position as required for installation of bond breakers, backer rods, and sealants. Do not leave voids or gaps between the ends of joint filler units.
  - a. Smooth Edged Joints: For joints between two concrete slabs or where new concrete abuts smooth-edged materials, use either cork joint filler or closed cell polyurethane joint filler.
  - b. Irregular Edged Joints: For joints where new concrete abuts granite curbs or other irregular edges, use closed cell polyurethane joint filler.
  - c. Prime all joint surfaces; Do not allow the primer/sealer to spill or migrate onto adjoining surfaces.

3.4 JOINT BACKING INSTALLATION

- A. Install bond breaker tape in relaxed condition as it comes off the roll. Do not stretch the tape. Lap individual lengths.
- B. Prevent three-sided adhesion by use of bond breaker tapes or backer rods at the back of the joint. Install backer rods for all liquid sealants, except where specifically recommended against by sealant manufacturers. Install backer rods immediately before sealants, do not permit backer rods to get wet. Install backer rods at the proper depth to create the specified sealant depth, avoid placing backer rods too deep which will result in sealant failure due to excessive sealant depth. Backup material shall be suitable size and shape so that when compressed 20 to 50%, it will fit in all joints where required. Do not cut or puncture the surface skin of the rod.
- C. Apply masking tape where required by surfaces encountered, and as may be determined by mockup testing, in continuous strips in alignment with joint edge. Remove tape immediately after joints have been sealed and tooled.

3.5 SEALANT INSTALLATION

- A. Prime surfaces where required with primer recommended by sealant manufacturer and as determined by "bond" test required in Part 1 of this Section.
- B. Apply, tool and finish sealant in accordance with manufacturer's recommendations.
- C. Install sealants with ratchet hand gun or other approved mechanical gun. Where gun application is impracticable, install sealant by knife or by pouring, as applicable. "Gun" devices shall have nozzles of proper size and shall provide sufficient pressure to completely fill joints as detailed.

- D. Finishing: Tool all vertical, non-sag sealants so as to compress the sealant, eliminating all air voids and providing a neat smoothly finished joint. Provide slightly concave joint surface, unless otherwise indicated or recommended by the manufacturer.

- 1. All tooling shall be "dry".

### 3.6 FIELD QUALITY CONTROL

#### A. Test Samples

- 1. If requested by the Owner's Representative, for each 1,000 linear feet of joint installed, cut out and carefully remove a 6 inch long sample of the undisturbed sealant and joint backer material from the newly installed Work. Remove the samples in the presence of the Testing Laboratory's Representative, who will retain them for evaluating and testing.
  - 2. Reseal cutout areas with the same type materials.

### 3.7 CLEANING

- A. Immediately remove misapplied sealant and droppings from metal surfaces with solvents and wiping cloths. On other materials, remove misapplied sealant and droppings by methods and materials recommended in writing by the manufacturer of the sealant material.
- B. After sealants are applied and before skin begins to form on sealant, remove all masking and other protection. Clean up remaining defacement caused by the Work.
- C. All finished work shall be left in neat, clean condition.

END OF SECTION

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Section 07 92 00  
JOINT SEALANTS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. General:
  - 1. This Section specifies general requirements, definition of joint sealer types, and application requirements for sealant work specified within other individual specification sections.
- B. Prepare sealant substrate surfaces, including removal of existing sealant and backing, and thorough cleaning of joints.
- C. Furnish and install sealant and backing materials.

1.3 RELATED REQUIREMENTS

- A. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing finishes, partitions and walls as indicated in the Drawings
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 10 00 - ROUGH CARPENTRY.
- D. Section 07 31 26 - SLATE SHINGLE ROOFING: Sealant used in conjunction with the installation of slate roofing.
- E. Section 07 62 29 - SHEET METAL FLASHING AND TRIM: Sealant integral with flashing.
- F. Section 07 84 00 - FIRESTOPPING: Firestopping sealants and related backing materials.
- G. Section 08 90 00 - LOUVERS AND VENTS.
- H. Section 08 51 13 - ALUMINUM WINDOWS.
- I. Section 09 29 00 - GYPSUM BOARD: Application of concealed acoustical sealant used in conjunction with gypsum board work at abutting surfaces (perimeter of partitions and walls).
- J. Section 09 30 00 - TILING.

- K. Section 09 91 00 - PAINTING: Caulks used in preparation of applied finish coatings.

#### 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. ASTM C 717 - Standard Terminology of Building Seals and Sealants.
  2. ASTM C 790 – Guide for Use of Latex Sealants
  3. ASTM C 804 - Use of Solvent-Release Type Sealants.
  4. ASTM C 834 - Latex Sealing Compounds.
  5. ASTM C 919 - Use of Sealants in Acoustical Applications.
  6. ASTM C 920 - Elastomeric Joint Sealants.
  7. ASTM C 962 - Use of Elastomeric Joint Sealants.
  8. ASTM C 1193 - Guide for Use of Joint Sealants.
  9. ASTM D 1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
  10. ASTM D 3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
- B. The following reference materials are hereby made a part of this Section by reference thereto:
1. SWRI – Sealant and Caulking Guide Specification.

#### 1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, chemical and physical properties and installation instructions for each item furnished hereunder.
  2. Selection Samples: Sample card indicating Manufacturer's full range of colors available for selection by Architect.
  3. Verification Samples: 12 inch long samples of sealant for verification of color, installed where directed by Architect.
  4. Stain resistance testing results for each natural stone material with specified sealants. Include additional testing for hydrophobic action after stone/sealant wetting and provide photographic records of tests.
  5. Certificates: Manufacturer's certification that the Products supplied meet or exceed specified requirements.
  6. Test and Evaluation Reports:
    - a. Compatibility and adhesion test reports: Test reports from sealant manufacturer indicating that sealant proposed for use have been tested for compatibility and adhesion with actual samples of substrates to be used on this project. Include sealant manufacturer's interpretation of test results, and recommendations for primers and substrate preparation specific to this Project.

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7. Sustainable Design Submittals:
    - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all joint sealants.
      - 1) Submit for interior sealants MSDS highlighting VOC limits as tested under ASTM D 3960.
  8. LEED Submittal Requirements:
    - a. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
      - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
        - a) The exposure scenario used to determine compliance.
        - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
        - c) Laboratory accreditation under ISO/IEC 17025.
        - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
      - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
      - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
    - b. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
      - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
        - a) The exposure scenario used to determine compliance.
        - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
        - c) Laboratory accreditation under ISO/IEC 17025.
        - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
      - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
      - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Bonds and Warranty Documentation: Manufacturer's standard Warranties and Guarantees.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Provide sealants from a single manufacturer for all work of this Section to the greatest extent possible. Each individual type of sealant installed in the Work shall be from a single manufacturer.
- C. Qualifications:
  1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.
  2. Testing Agencies: To qualify for acceptance, an independent testing laboratory must demonstrate to Architect's satisfaction that it has the experience and capability to conduct satisfactory testing indicated without delaying progress of the Work.
- D. Preconstruction Compatibility and Adhesion Testing: Submit samples of all materials that will contact or affect joint sealers to joint sealer manufacturers for compatibility and adhesion testing, as indicated below:
  1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealers to joint substrates.
    - a. Perform tests under normal environmental conditions that will exist during actual installation.
  2. Contractor shall submit for testing, and sealant manufacturer shall test at least 9 pieces of each type of material, including joint substrates, shims, and joint backer rods.
  3. Schedule testing so that it does not delay the work.
  4. Investigate materials failing these tests and obtain joint sealer manufacturer's written recommendations for corrective measures, including use of specially formulated primers.
  5. The Architect may waive part or all of these specific testing requirements if the sealant manufacturer is able to provide written certification, demonstration to the Architect's satisfaction, that sealant and substrates are compatible and that sealant performance and adhesion will not be compromised by project conditions.
- E. Product Testing: Provide comprehensive test data for each type of joint sealer based on tests conducted by a qualified independent testing laboratory on current product formulations within 24-month period preceding date of Contractor's submittal of test results to Architect.
  1. Test elastomeric sealant for compliance with requirements specified by reference to ASTM C920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C719), low-temperature flexibility, modulus of elasticity at 100% strain, effects of heat aging, and effects of accelerated weathering.



2. Include test results performed on joint sealers after they have cured 1 year.
- F. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:
1. Locate test joints where indicated or, if not indicated, as directed by Architect.
  2. Conduct field test for each type of elastomeric sealant and joint substrate indicated.
  3. Arrange for tests to take place with both Architect and joint sealer manufacturer's technical representative present.
  4. Test Method: Test joint sealers by hand pull method described below:
    - a. Install joint sealant in 5-foot joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealant to cure fully before testing.
    - b. Make knife cuts as follows: A horizontal cut from one side of joint to the other followed by 2 vertical cuts approximately 2 inches long at side of joint and meeting horizontal cut at top of 2 inch cuts. Place a mark 1 in. from top of 2 inch piece.
    - c. Use fingers to grasp 2 inch piece of sealant above 1 in. mark; pull firmly down at 90 degree angle or more while holding a straightedge along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
  5. Evaluation of field test results:
    - a. For sealant evidencing adhesive failure, determine if primer is required. If so, re-test using primer.
    - b. Sealant not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory.
    - c. Do not use sealant which fails to adhere to joint substrates during testing.
  6. Submit report to Architect with description of test, results, and recommended installation procedures to obtain proper adhesion.
    - a. Report whether or not sealant in joint connected to pull-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
- 1.7 DELIVERY, STORAGE AND HANDLING
- A. Each container and package must bear an unbroken seal, test number and label of the manufacturer upon delivery to the site. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by the Architect and his requiring its removal from the site. New material conforming to said requirements, shall be promptly furnished at no additional cost to the Contract.
- 1.8 SITE CONDITIONS
- A. Do not install single component solvent curing sealant in enclosed building spaces.
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- B. Environmental Requirements: Maintain temperature and humidity recommended by the sealant manufacturer during and 24 hours after installation. Do not proceed with installation of joint sealers under the following conditions:
  - 1. When ambient and substrate temperature conditions are below 40 degrees F.
  - 2. When joint substrates are wet due to rain, frost, condensation, or other causes.
- C. Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from substrates.

## 1.9 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manufacturer's warranties shall guarantee sealants installed are free of manufacturing defects and conforms to the published physical properties and referenced standards effective at time of installation.
  - 1. Sealant performance: Manufacturer's warranties shall include coverage for the following listed failures, when sealants are applied in accordance with manufacturer's written instructions. Warranty to include coverage for:
    - a. Sealant will not become brittle, tear or crack due to normal exposure or normal expansion or contraction.
  - 2. Warranty period:
    - a. Silicone sealants on vertical surfaces: 20 years.
    - b. Urethane sealants on vertical surfaces: 5 years.
    - c. Urethane sealants on horizontal surfaces: 5 years.
- C. Installer's warranty: Provide 3 year warranty or bond which shall include coverage of installed sealant and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.
  - 1. Installer's warrant shall include coverage for sealant that fails cohesively or adhesively.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Specified Manufacturers and Products: To establish a standard of quality, design and function desired, Drawings and specifications have been based on the products specified under this section for each individual sealant type, for the applications scheduled at the end of Section, and as may be additionally identified on the Drawings.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  - 1. BASF Construction Chemicals (Sonneborn), Shakopee MN.
  - 2. Bostik, Inc., Wauwatusa, WI.
  - 3. Dow Corning Corporation, Auburn MI.

4. Momentive Performance Materials (GE Silicones), Waterford NY.
5. Owens Corning, Toledo, OH.
6. Pecora Corporation, Harleysville PA.
7. Phenomenal Brands, Baltimore, MD.
8. Sika Corp, Lyndhurst NJ.
9. Tremco, Inc., Beachwood OH.

## 2.2 SEALANT MATERIALS

- A. Sealant Materials, General Requirements:
1. Only use sealant and primers that comply with the following limits for VOC content:
    - a. Architectural Sealants: 250 g/L.
    - b. Roofing Sealants: 420 g/L.
    - c. Roadway Sealants: 250 g/L.
    - d. Sealant primer: 250 g/L.
  2. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.
- B. Joint Sealer Type AA (Acrylic acoustical): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable.
1. Owens Corning, product: "QuietZone Acoustical Sealant."
  2. Pecora, product "AC-20 FTR".
  3. Tremco, product "Tremco Acoustical Sealant".
- C. Joint Sealer Type AP (Acrylic painters caulk): One component acrylic latex caulking compound, conforming to ASTM C 834 Type P, Grade NF, paintable within 24 hours after application, with a minimum movement capability of  $\pm 12.5$  percent, equal to one of the following:
1. BASF (Sonneborn), product, "Sonolac".
  2. Tremco, product, "Tremflex 834".
  3. Bostik, product, "Chem-Calk 600".
  4. Pecora, product "AC-20+".
- D. Joint Sealer Type BPM (Bitumen modified polyurethane, Multi-component): Pouring grade self-leveling bitumen modified two component urethane sealant, conforming to ASTM C920, Type M, Grade P, Class 25 and FS SS-S-00227E, Type 1, Class A, with a minimum movement capability of  $+50/-25$  percent, equal to one of the following:
1. BASF (Sonneborn), product "Sonomeric 2".
  2. Pecora, product "Urexpan NR-300".
  3. Tremco, product "Vulkem THC 900/901".
  4. Sika, product "Sikaflex 2CNS".

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- E. Joint Sealer Type HLM (Horizontal-self-Leveling, Multi-component): Pouring grade self-leveling multi-component urethane sealant, conforming to ASTM C 920, with a minimum movement capability of  $\pm 25$  percent, equal to the following:
1. BASF (Sonneborn), product, "Sonolastic SL 2" (self-leveling grade).
  2. Sika, product, "Sikaflex 2CSL".
  3. Tremco, product, "THC-900 / THC-901".
- F. Joint Sealer Type HT (Horizontal-Trowel): Trowel grade multi-component modified-urethane or neutral-cure silicone paste sealant, conforming ASTM C 920, with a minimum movement capability of  $\pm 25$  percent, equal to the following:
1. BASF (Sonneborn), product "Sonolastic SL 2 (slope grade)" (urethane).
  2. GE silicones, product "Tosseal 811" (silicone).
  3. Pecora, product "Dynatred" (urethane).
  4. Sika, product "Sikaflex 2CTG" (urethane).
  5. Tremco, product "THC-901" (urethane).
- G. Joint Sealer Type FJS (Expanding Foam Joint Sealant): Open cell polyurethane foam impregnated with an acrylic-polymer-modified, non-drying water-based asphalt emulsion.
1. Impregnation agent to have proven non-migratory characteristics.
  2. Compression when expanded in joint shall be at approximately 25% of its uncompressed dimension (4x compression).
  3. Material to be supplied in sticks or rolls, precompressed to less than joint size at mean temperature for ease of installation.
    - a. Roll material will contain a nylon mesh (to reduce stretching) embedded into a pressure-sensitive adhesive on one side of the material.
    - b. Stick material to contain a pressure-sensitive adhesive on one face for aid in application.
  4. Color: Black.
  5. Acceptable products, or approved equal:
    - a. Emseal, product "25V".
    - b. Schul (Sealtite Brand), product "Sealtite Standard".
    - c. Tremco, product "WillSeal 600" or "ExoAir Trio"
- H. Joint Sealer Type SC (Silicone, general construction): One-part medium modulus, natural cure, synthetic sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 50, use NT, G, A, M, O with a minimum movement capability of  $\pm 50$  percent, equal to the following:
1. Dow Corning, product, "791".
  2. GE Silicones, product, "Silpruf".
  3. Pecora, product, "895".
  4. Sika, product, "Sika Sil-C 995".
  5. Tremco, product, "Spectrem 2".

- I. Joint Sealer Type SX (Silicone, Exterior construction): Medium modulus, neutral curing, low to no bleed silicone passing ASTM C1248, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, Grade NS, Class 50, with a minimum movement capability of +50 percent and -50 percent, equal to the following:
  - 1. Dow Corning, product, "795".
  - 2. GE Silicones, product, "SCS9000 SilPruf NB".
  - 3. Sika, product "Sikasil-WS-295".
  - 4. Tremco, product "Spectrem 4-TS".
  
- J. Joint Sealer Type SF (Silicone, Food contact): One component silicone rubber, acceptable to local health officials, conforming to U.S. Food and Drug Administration regulation 21 CFR 175.105 and 175.300, and ASTM C 920, Type NS, Class 25, Use NT, G, O and A with a minimum movement capability of  $\pm 25$  percent, and a Shore A minimum hardness of 20, equal to the following:
  - 1. Dow Corning, product, "732".
  - 2. GE Silicones, product "Series SCS1000".
  - 3. Tremco, product "Tremsil 200".
  
- K. Joint Sealer Type SM (Silicone, Mildew-resistant): USDA approved one component acetoxysilicone rubber, mildew resistant, acceptable to local health officials, conforming to U.S. Food and Drug Administration regulation 21 CFR 177.2600, and ASTM C 920, Type S, Class 25, Grade NS, use NT, G and A with a minimum movement capability of  $\pm 25$  percent, and a Shore A hardness of 20, equal to the following:
  - 1. BASF (Sonneborn), product "OmniPlus".
  - 2. Dow Corning, product "786".
  - 3. GE Silicones, product "Sanitary 1700".
  - 4. Tremco, product "Tremsil 200 Sanitary".
  - 5. Pecora, product "898NST".
  
- L. Joint Sealant: Type SSV: Medium modulus, neutral curing, no bleed silicone passing ASTM C1248, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, Grade NS, Class 50, use NT, G, M, A, and O, with a minimum movement capability of +50 percent and -50 percent, equal to the following:
  - 1. Dow Corning, product, "756 SMS".
  - 2. GE Silicones product: "SCS9000 SilPruf NB"
  - 3. Tremco product "Spectrim 3"

### 2.3 ACCESSORIES

- A. Compressible joint bead back-up: Compressible closed cell polyethylene, extruded polyolefin or polyurethane foam rod complying with ASTM C 1330, Type C, 1/3 greater in diameter than width of joint. Shape and size of compressible back-up shall be as recommended by manufacturer for the specific condition used. Provide one of the following, or equal.

1. Construction Foam Products (Division of Nomaco, Inc.), Zebulon, NC, product "HBR Closed Cell".
  2. Industrial Thermo Polymers Ltd., Brampton, Ontario CN, product "ITP Standard Backer Rod".
  3. BASF Construction Chemicals (Sonneborn), Shakopee MN, product "Sonolastic Closed Cell Backer Rod".
  4. W.R. Meadows Inc., Hampshire, IL, product "Sealtight Kool-Rod".
- B. Primers: Furnish and install joint primers of the types, and to the extent, recommended by the respective sealant manufacturers for the specific joint materials and joint function.
- C. Bond-breaker tape, and temporary masking tape: Of types as recommended by the manufacturer of the specific sealant and caulking material used at each application, and completely free from contaminants which would adversely affect the sealant and caulking materials.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Inspect existing joints to be renovated.
1. Verify joint sealants, backing, and other materials containing PCBs and other hazardous materials have been removed.
  2. Verify joint substrates and adjoining materials are structurally sound.
  3. Verify joints to be renovated can be satisfactorily repaired with specified methods and materials.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION**

- A. General:
1. Weather conditions must be dry and of the temperature, as recommended by sealant manufacturer, during application operations.
  2. Surface receiving work of this section must be absolutely dry and dust free. All joints receiving sealant/caulking materials and primers shall be subject to the approval of the sealant manufacturer for proper use of specified materials.
- B. Thoroughly clean all joints, removing all loose mortar, oil, grease, dust, frost, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
1. Clean ferrous metals of all rust and coatings by wire brush, grinding or sandblasting. Remove oil, grease and protective coatings with cleaners recommended by sealant manufacturer.

2. Where sealant is indicated to replace existing, thoroughly remove existing sealant and backing, scrape and clean surfaces. Renovate sealant joints in accordance with manufacturer's instructions and reviewed shop drawings. Remove all existing sealant residue from joint surfaces using chemical cleaners and solvents which are acceptable to sealant manufacturer.
- C. Prime joint substrates, as recommended in writing by joint-sealant manufacturer, as based on preconstruction joint-sealant-substrate tests or as based upon prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
  - D. Verify that joint backing and release tapes are compatible with sealant.
  - E. Perform preparation in accordance with ASTM C 804 and C 790 for solvent and latex base solvents, respectively.
- 3.3 PREPARATION FOR REPLACEMENT OF EXISTING SEALANT
- A. Remove existing joint sealants and backing as shown on drawings and identified during pre-installation conference and inspection (Article 3.1 herein above). Do not remove silicone joints to be recapped and joints to be covered with silicone seals.
  - B. Cut existing sealant close to joint edges.
  - C. Clean joint with power or hand wire brush, grinding, saw cutting, or solvent cleaning to depth at which replacement backing and sealant are to be installed.
  - D. Blow out dust, loose particles, and debris with moisture and oil-free compressed air. Remove any pieces of caulk and backer rod lodged in joint.
  - E. Repair deteriorated or damaged substrates as recommended by sealant manufacturer to provide suitable substrate for new sealant. Allow patching materials to fully cure.
- 3.4 INSTALLATION
- A. General: Conform to SWRI requirements, and sealant manufacturer's written requirements for installation.
  - B. Install joint bead back-up in all joints in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.
    1. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
    2. Do not stretch back-up material into joints.
  - C. Install bond breaker in joints where shown in the Drawings and wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.
  - D. Apply masking tape or other precautions to prevent migration or spillage of materials onto adjoining surfaces.
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- E. Apply urethane sealants, silicone sealants, and latex caulking materials into joints in accordance with manufacturer's instructions, using mechanical or power caulking gun equipped with nozzle of appropriate size, with sufficient pressure to completely fill the joints.
  - 1. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
  - 2. Maintain the outer edge of the sealant and caulking materials, where side faces of joints are in the same plane, back 1/8-inch from the faces.
  - 3. Apply sealant in continuous beads without open joints, voids or air pockets so as to provide a watertight and airtight seal for the entire joint length.
  - 4. After placement of the sealant and caulking materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.
  - 5. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.
- F. Take care not to block-off weep tubes or any through wall opening constructed to allow weeping of accumulated water.
- G. Apply pouring self-leveling urethane sealant (Sealant designation **HL**) into horizontal joints in accordance with manufacturer's instructions, to a level approximately 1/16 inch below adjacent surfaces.
  - 1. Apply sealant without open joints, voids or air pockets so as to provide a watertight and airtight seal for the entire joint length.
  - 2. After placement of the sealant and caulking materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.
  - 3. Remove the temporary masking tape immediately after tooling, and before the sealant has taken initial set.

### 3.5 CLEANING

- A. Clean all surfaces of adjacent surfaces which have been marked or soiled by the work of this Section, removing all excess sealant and caulking materials with solvents which will not damage the surfaces in any way.

### 3.6 PROTECTION

- A. During the operation of sealant work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

### 3.7 SCHEDULE

- A. General: Seal joints indicated and all interior and exterior joints, seams, and intersections between dissimilar materials.
- B. Sealant Colors:
  - 1. Colors for Sealant Types "HLM": Match colors furnished by the Architect, or match other building materials as directed. Should such custom colors not be



available from the approved manufacturer, except at additional charge, provide all such colors at no change in Contract Sum.

2. Colors for Sealant Types "HT", "SC", "SX", "SSV" and "SM": As selected by the Architect from manufacturer's standard colors.
  3. Color for Sealant Types "AA" and "AP": White.
  4. In concealed installation, and in partially or fully exposed installation where so approved by the Architect, standard gray or black sealant may be used.
- C. Foam sealant at indicated, and elsewhere approved locations: Sealant Type FJS.
- D. Exterior joints (Listed by primary building material abutting sealant joints):

1. Concrete (including precast):

Joint Condition	Sealant Type
a. Concrete to concrete, vertical control joints:	SX
b. Concrete foundation walls to abutting concrete, and other non-bituminous pavements, steps, platforms, and ends of ramp, (horizontal joints):	HLM
c. Concrete slabs on grade to abutting non-bituminous pavements (horizontal joints, including pedestrian traffic surfaces):	HLM
d. Concrete and non-bituminous sloped (5% to 12%) pavement ramps (horizontal joint) at abutting concrete or masonry foundation walls:	HT
e. Concrete to all items which penetrate exterior concrete walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items:	SX
f. Precast concrete to abutting materials (vertical joints):	SX

2. Exterior Masonry (Excluding Natural Stone):

Joint Condition	Sealant Type
a. Masonry to masonry, expansion and control joints, 1 inch and less:	SX
b. Masonry to abutting masonry, or concrete:	SX
a. Masonry to abutting stone:	SSV
b. Masonry to abutting non-porous materials (painted metals, anodized aluminum, mill finished aluminum, PVC, glass, and similar materials):	SX
c. Masonry to all items which penetrate exterior masonry walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items:	SX

3. Exterior Stone:

Joint Condition	Sealant Type
a. Stone to stone, expansion and control joints:	SSV

- b. Stone to abutting masonry, stone or concrete: SSV
  - c. Stone to abutting non-porous materials (painted metals, anodized aluminum, mill finished aluminum, PVC, glass, and similar materials): SSV
  - d. Stone to all items which penetrate exterior stone walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items: SSV
4. Exterior Metal:
- | Joint Condition    | Sealant Type |
|--------------------|--------------|
| a. Metal to metal: | SX           |
| b. Metal to glass: | SX           |
5. Exterior wood and plastic:
- | Joint Condition                            | Sealant Type |
|--|--------------|
| a. Wood to wood (painted opaque finishes): | SX           |
| b. Wood to metal:                          | SX           |
6. Foam sealant at indicated locations: Sealant Type FJS
- E. Interior joints (Listed by primary building material abutting sealant joints):
- 1. Interior Concrete:
- | Joint Condition  | Sealant Type |
|--|--------------|
| a. Concrete to concrete (including precast), vertical joints:  | SC           |
| b. Concrete to concrete: horizontal walkable surfaces:   | HLM          |
| c. Concrete to all items which penetrate concrete walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items: | SC           |
| d. Precast concrete to abutting materials (vertical joints):   | SC           |
- 2. Gypsum Board:
- | Joint Condition  | Sealant Type |
|--|--------------|
| a. Gypsum board to metal or wood trim:   | AP           |
| b. Gypsum board to abutting surfaces at exposed tops and bottoms partitions and walls:   | AA           |
| c. Gypsum board to masonry:  | SC           |
| d. At gaps and spaces between gypsum board to interior door and window frames, penetrating conduits and piping, building specialty items, ductwork, and similar items: | AP           |
| e. Gypsum board to plumbing fixtures:  | SM           |
- 3. Plaster and veneer plaster:
- | Joint Condition                   | Sealant Type |
|-----------------------------------|--------------|
| a. Plaster to metal or wood trim: | AP           |

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b.	At gaps and spaces between plaster to interior door and window frames, penetrating conduits and piping, building specialty items, ductwork, and similar items:	AP
c.	Plaster to plumbing fixtures:	SM
4.	Architectural millwork and casework:	
	<u>Joint Condition</u>	<u>Sealant Type</u>
a.	Casework to abutting materials, kitchens, toilet rooms and similar "wet spaces":	SM
b.	Casework to abutting surfaces (except in "wet" spaces):	AP
c.	Countertops to abutting wall surfaces and to abutting casework:	SM
d.	Countertops to plumbing fixtures and fittings:	SM
5.	Interior metal:	
	<u>Joint Condition</u>	<u>Sealant Type</u>
a.	Metal to metal:	SC
6.	Interior floor drains:	
	<u>Joint Condition</u>	<u>Sealant Type</u>
a.	Floor drains to concrete slab:	SC
b.	Floor drains to resilient sheet flooring:	SC
7.	Acoustical ceilings:	
	<u>Joint Condition</u>	<u>Sealant Type</u>
a.	Acoustical ceiling edge angle to irregular wall surface	AP
8.	Tile:	
	<u>Joint Condition</u>	<u>Sealant Type</u>
a.	Tile to tile vertical, and horizontal non-traffic joints:	SM
b.	Tile to tile, horizontal pedestrian traffic joints:	HLM
9.	Sanitary plastic wall and ceiling panels to abutting surfaces	
	<u>Joint Condition</u>	<u>Sealant Type</u>
a.	Sanitary plastic panels to abutting materials:	SM
10.	Interior Wood:	
	<u>Joint Condition</u>	<u>Sealant Type</u>
a.	Wood to wood (natural or stained finishes)	SC
b.	Wood to wood (painted opaque finishes)	AP
c.	Wood to metal	SC
d.	Wood base to wall surfaces	SC

End of Section

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Section 08 05 13

COMMON WORK RESULTS – INSTALLATION DOORS AND HARDWARE

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. This Section includes general requirements for preparation, installation and temporary protection for door frames, doors and door hardware. Work additionally includes:
  - 1. Fitting and preparation of hardware for unfinished wood doors.
  - 2. Installation of lock cylinders into special doors.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 48 46 –FIRE RATED WOOD DOOR FRAMES.
- D. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES
- E. Section 08 14 16 - FLUSH WOOD DOORS
- F. Section 08 14 33 - STILE AND RAIL WOOD DOORS
- G. Section 08 14 34 – CUSTOM FABRICATED STILE AND RAIL WOOD DOORS

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - References. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
  - 2. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors or Steel Frames View Scope
  - 3. ANSI/BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames

4. ANSI/SDI A250.8 – Recommended Specifications for Standard Steel Doors and Frames.
5. ANSI/SDI A250.11 – Recommended Erection Instructions for steel frames.
6. All applicable federal, state and municipal codes, laws and regulations for exits.
7. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
8. NFPA publication 80 - Fire Doors and Windows.
9. WDMA Industry Standard IS 1A-13.
10. UBC 43.2 – Fire Tests of Door Assemblies.
11. UL 10B - Fire Tests of Door Assemblies.
12. UL 10C – Positive Pressure Fire Door Test Method.
13. Warnock-Hersey - Certification Listings for fire doors.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing:
1. Field Measurements
    - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
    - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

#### 1.6 SUBMITTALS

- A. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
1. Tools: Tools for maintenance: All special tools packaged with hardware items shall be saved, tagged/identified as to product use, and turned over to the Owner upon completion of the Work.

#### 1.7 QUALITY ASURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards, existing materials, and existing methods of construction.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. The Contractor is responsible to make certain that wood doors are not delivered until the building and storage areas are sufficiently dry so that the doors will not be damaged by excessive changes in ambient humidity and relative moisture content.
- B. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
    - a. Tag or label packages with door opening number(s) coordinated with door and hardware schedule.
  3. Inspect doors upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
  4. Store wood doors flat on a level surface, in protected, elevated, dry areas; protect from exposure from all sources of light and moisture. When required to maintain manufacturer's warranty, seal top and bottom edges if stored more than one week. Break packaging seal on-site to permit ventilation.
- C. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- D. Packaging Waste Management: Comply with disposal and recycling requirements specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
- E. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.
- 1.9 SITE CONDITIONS
- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period

## **PART 2 - PRODUCTS**

### **2.1 ACCESSORIES**

- A. Fasteners: Use fasteners furnished with hardware for installation.
1. Where fasteners are not furnished with item, use fasteners of suitable size and type to harmonize with item as to material and finish and to suit material to which fastened.
  2. Use machine screws and metal expansion shields to secure hardware to concrete, ceramic or quarry tile, or solid masonry. Do not use fiber, plastic, and lead plugs or adhesives.
  3. Use non-ferrous metal fastenings exposed to weather.

- a. Brass/Bronze finish hardware: Bronze fasteners, matching finish of hardware.
  - b. Aluminum, stainless steel and painted steel hardware: Type 302/304 stainless steel fasteners.
  - c. Chrome finish hardware: Chrome plated brass/bronze fasteners.
- B. Hinge Shims:
1. Interior door shims:
    - a. Typical hinges: steel shims in thickness for conditions required.
    - b. Stainless steel hinges: Stainless steel, type 302 or 304, thickness for conditions required.
    - c. Brass/bronze hinges with brass/bronze frames: Architectural bronze sheet in thickness for conditions required.
  2. Exterior door frame shims:
    - a. All hinge materials: Stainless steel, type 302 or 304, thickness for conditions required.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive doors and frames.
1. Verify that opening sizes and tolerances are acceptable and in compliance with these specifications and applicable codes.
  2. Beginning of installation means acceptance of existing substrate and project conditions.

#### **3.2 PREPARATION**

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.

#### **3.3 GENERAL ERECTION/INSTALLATION FRAMES AND DOORS**

- A. General: Install frames and doors in accordance with the manufacturer's recommendations, ANSI/SDI-100, ANSI A250.8, SDI-105, NFPA-80 and the Door Hardware Institute recommendations. Install with a maximum diagonal distortion of 1/16 inch measured with a straight edge, corner to corner.
- B. Installation of fire-resistance rated and smoke rated doors:
1. Install fire rated doors in accordance with NFPA 80.
  2. Do not remove qualified testing and inspection agency label.
  3. Owner, at its option may retain a third-party inspector to review installation of fire-resistant rated door openings for compliance with NFPA 80.



- C. Final installation of loosely-attached glazing stops will be performed under Section 08 80 00 - GLAZING.

### 3.4 ERECTION/INSTALLATION METAL DOOR FRAMES

- A. Place in-position all steel frames, in accordance with the approved shop drawings and frame schedule.
  - 1. During the installation of metal door frames, after the manufacturer's steel shipping bars have been removed, install wood spreaders at door opening, carefully dimensioned to permit square and plumb installation of door frames and doors.
    - a. Provide rigid temporary bracing for frames as required to ensure maintenance of positioning, and remove only after frames have been permanently anchored.
    - b. For doors located in masonry work, maintain frame position with temporary bracing until frames are built-into-place, and grout has sufficiently cured to maintain frame position.
    - c. Spreaders shall remain in place until doors are installed.
  - 2. Coordinate installation of frames with the various trades installing abutting wall construction for anchor placement.
    - a. Secure frames with the following number of anchors per jamb.
      - 1) For frames 7'-6" in height or less: 3 anchors per jamb.
      - 2) For frames 7'-6" in height or less and having doors exceeding 3'-0" feet width, and for cross corridor frames: 4 anchors per jamb.
      - 3) For frames greater than 7'-6", up to 10'-0" in height: 4 anchors per jamb.
      - 4) For frames greater than 7'-6", up to 10'-0" in height, and having doors exceeding 3'-0" feet width, and for cross corridor frames: 5 anchors per jamb.
      - 5) For frames over 10'-0" in height: 5 anchors per jamb.
  - 3. Secure frames, occurring in existing masonry, with expansion bolts and sleeves.
  - 4. Where exposed fastener heads occur in frames, fill with automotive body filler and sand smooth.

### 3.5 ERECTION/INSTALLATION WOOD DOOR FRAMES

- A. Place in-position all wood door frames, in accordance with the approved shop drawings and frame schedule.
  - 1. Provide rigid temporary bracing for frames as required to ensure maintenance of positioning, and remove after frames have been permanently anchored.
  - 2. At rated wood door frames, install fire clips where required by manufacturer, or as required for fire-resistant label.

### 3.6 GENERAL INSTALLATION DOORS AND HARDWARE

- A. General: Install doors and door hardware in accordance with manufacturer's instructions and requirements of referenced organizations, and the requirements of Section 08 71 00 - DOOR HARDWARE.

1. Center doors in the opening or frame with contact surfaces fit tight and even without forcing or warping the components.
  2. Do not hang wood doors in areas where materials are not sufficiently dry so as to not affect the dimensional stability of the door.
  3. Replace doors and frames that do not conform to hardware height requirements.
  4. All doors and frames: Space between door and frame shall not exceed 1/8 inch, including new doors installed into existing frames.
- B. Hang doors and install hardware when concrete work, plastering, tile setting, and other operations have been completed which increase humidity and dust in building.
- C. Install hardware (except hinges) after field painting of doors and frames, or field sealing of doors has been completed.
- D. Drill and tap screw holes in steel frames and doors for surface mounted hardware.
- E. Install hardware at the location (heights) indicated on Drawings, or as otherwise required by regulatory requirements.
- F. Carefully fit and securely attach hardware items to doors and frames.
- G. Closers including those with hold-open features:
1. Where closers are mounted on doors, mount with hex nuts and bolts; fasten foot to frame with machine.
  2. Mount to provide maximum door opening permitted by building construction or equipment.
  3. Use regular arm mounting except where door swing is less than 90 degrees or closer is on interior of exterior door or door is equipped with roller latch.
- H. Thresholds:
1. Install thresholds in a bed of sealant with machine screws and expansion shields.
  2. Cut thresholds to closely fit jambs.
  3. Drill and cut for door holders and bottom bolts where required.
- I. Rain Drips: Install rain drips for heads of door frames not protected by canopy or soffit.
- J. Weatherstripping and seals:
1. Accurately cut and fit weatherstrips and seals. Carefully aligned for full contact and tight seal and secure firmly to maintain weatherproof, waterproof, and lightproof seal without preventing smooth and easy operation of doors.
  2. Provide suitable blocking where necessary to clear hardware; and make adjustments as required to meet special conditions encountered.
  3. Prime paint wood surfaces which have been cut with wood sealer before weatherstrips are installed.

4. Light seals: Install seals on door frames for lightproof doors. Secure seals to door frames at jamb and heads with contact adhesive to prevent infiltration of light.
5. Sound control devices: Install sound rated door gasketing and bottom seal, and adjust to obtain the specified sound rating.
6. Automatic Door Bottoms: Install automatic door bottom so that gasket is automatically forced down to tightly seal instantly when the door is fully closed, and raised instantly when the door begins to open. Mount automatic door bottom to provide 5 mm (3/16 inch) clearance at door bottom.

### 3.7 TOLERANCES

- A. All doors and frames: Space between door and frame shall not exceed 1/8 inch, including new doors installed into existing frames.
- B. Maximum door undercut to be 3/4 inch, coordinate with floor leveling and floor finishes.

### 3.8 FIELD FITTING AND INSTALLATION OF WOOD DOORS

- A. Do not alter pre-fit and pre-finished doors.
- B. Field-fitted doors:
  1. Unless otherwise detailed, fit hinged doors with 3 mm (1/8 inch) clearance at hinge stiles, 3 mm (1/8 inch) at top and lock or meeting stiles, and 19 mm (3/4 inch) between bottom rail and floor.
  2. Bevel lock edge and meeting stile of single acting wood doors 3 mm (1/8 inch) for each 50 mm (2 inches) of door thickness.
  3. Immediately after fitting and cutting of wood doors for hardware, seal edges of doors as specified in Section 09900, PAINTING.
  4. Mortise wood doors for hardware using templates furnished under Section 08 71 00 – DOOR HARDWARE.
  5. Cut sinkages for lock fronts, strikes, hinges and similar items same size as item installed.

### 3.9 ADJUSTING

- A. Adjust Doors, including hardware to operate as designed without binding or deformation of the members.
- B. After installation, clean surfaces, remove temporary labels, paint spots and other defacement.
- C. Clean prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the manufacturer.
- D. Prior to Final Inspection make final check and adjustment of all hardware, clean operating items as necessary to restore proper function and finish of hardware.

3.10 TOUCH-UP FINISHES

- A. Field touch-up of doors, scheduled for opaque finishes, will be performed under Section 09 91 00 - PAINTING and includes the filling and touch-up of exposed job made nail or screw holes, refinish of raw surfaces resulting from fitting or job inflicted scratches and marks.
- B. Field touch-up of doors, scheduled for transparent finishes, will be performed by an authorized representative of the door fabricator. Touch-up includes refinishing surfaces resulting from fitting, or job inflicted scratches and marks.

3.11 CLEANING

- A. General: Clean work under provisions of Section 01 73 00 - EXECUTION.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment, packing materials, and all rubbish and debris from the work area; leave area in broom-clean condition.
  - 1. Daily clean work areas by sweeping and disposing of debris.
- C. Clean adjacent surfaces soiled by hardware installation.
- D. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.12 PROTECTION

- A. Protect doors and hardware from damage until completion of the project. Comply with provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

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Section 08 11 13  
HOLLOW METAL DOORS AND FRAMES

**PART 1 – GENERAL**

1.1 SUMMARY

- A. Provide the following products:
  - 1. Flush UL-Labeled and non-labeled steel doors and frames, complete with internal reinforcing, hardware cut-outs; and provided with glazing openings, where so indicated; installed under requirements of Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION
  - 2. Hollow metal frames for fixed-glazed lites, complete with internal reinforcing; installed under requirements of Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.

1.2 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, and nailers.
- D. Section 06 20 00 - FINISH CARPENTRY: Wood casing and trim.
- E. Section 07 92 00 - JOINT SEALANTS.
- F. Section 08 05 13 – COMMON WORK RESULTS – INSTALLATION DOORS AND HARDWARE: Installation of doors and frames.
- G. Section 08 14 16 - FLUSH WOOD DOORS: Furnishing wood doors to be installed in hollow metal frames.
- H. Section 08 14 33 - STILE AND RAIL WOOD DOORS: Furnishing wood doors to be installed in hollow metal frames.
- I. Section 09 91 00 - PAINTING: Applied finish coatings.
- J. Division 26 – ELECTRICAL: Wiring connections for electrified door hardware.
- K. Building-in of frame anchors to wall and partition construction: By trade responsible for wall and partition erection.

1.3 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.8 – *R2008* (formerly SDI 100) - Recommended Specifications for Standard Steel Doors and Frames.
4. ANSI/SDI A250.11 – Recommended Erection Instructions for Steel Frames.
5. SDI 111 Series (111A-111F): Recommended Details, Steel Doors and Frames.
6. SDI 117-93: Manufacturing Tolerances for Standard Steel Doors and Frames.
7. NFPA publication 80 - Fire Doors and Windows.
8. NFPA publication 105 – Standard for the Installation of Smoke Door Assemblies.
9. UL publication 10B - Fire Tests of Door Assemblies.
10. UL publication 10C – Positive Pressure Fire Tests of Door Assemblies.
11. UL 1784 – Air Leakage Tests of Door Assemblies.
12. All applicable federal, state and municipal codes, laws and regulations for exits.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.
2. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing doors and frames.
3. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
4. Do not fabricate doors or frames before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and accepted by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

##### B. Sequencing:

1. Field Measurements:
  - a. Take field measurements before preparation of shop drawings and fabrication of frames scheduled for existing openings, to ensure proper fitting of Work.
  - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

## 1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, for doors, frames and shop applied finishes.
  2. Shop Drawings:
    - a. Door and Frame Schedule: A complete schedule coordinated with, and using same identifier designations as, the door and frame schedule contained in the Contract Drawings.
    - b. Large scale details of each type door and frame construction, indicating all gages, reinforcing, and anchorage.
      - 1) Indicated cutouts for glazing.
  3. Certificates: Manufacturer's written certification stating that doors, frames, and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section; that specified galvanized and shop priming has been performed; and that all U.L. fire-resistive requirements for the indicated Labels have been met.
  4. LEED Submittal Requirements:
    - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
      - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
        - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
        - b) EPD shall have at least Cradle to Gate scope,
      - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
    - b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
      - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
        - a) Itemized vendor invoices for FSC-certified products.
        - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
      - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
    - c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
      - 1) Recycled Content:
        - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.

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- b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
  - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
    - a) Documentation should be in the form of one of the following:
    - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
    - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
    - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
    - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
    - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
  - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
    - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
      - a) The exposure scenario used to determine compliance.
      - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
      - c) Laboratory accreditation under ISO/IEC 17025.
      - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
    - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
    - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- 1. Bonds and Warranty Documentation: Manufacturer's standard warranty.



1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards, specified materials, and methods of construction.
- B. Sole Source: Obtain doors and frames specified in this Section from a single manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  - 1. Prior to shipping, identify each frame and door with a removable metal or plastic label which corresponds with door schedule identifying opening number and location.
  - 2. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  - 3. Deliver doors and frames boxed or crated to provide protection during transit and job storage.
  - 4. Inspect doors and frames upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
- B. Storage and Handling Requirements:
  - 1. Store and handle materials following manufacturer's recommended procedures.
  - 2. Store doors and frames at the building site upright and under cover. Place the units on wood dunnage and cover in a manner that will prevent rust and damage.

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  - 1. Amweld Building Products, Inc., (A Division of Amweld International, LLC), Coppell TX.
  - 2. Ceco Door Products (A Division of Assa Abloy Group Company), Milan TN.
  - 3. Curries Company (A Division of Assa Abloy Group Company), Mason City IA.
  - 4. Republic Doors and Frames, McKenzie TN.
  - 5. Steelcraft (A Division of Allegion Company), Cincinnati OH.

2.2 DESCRIPTION

- A. Regulatory Requirements:
  - 1. Fire resistance rated door construction shall conform to UL publications 10B and 10C.

- a. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Fire resistance rated borrowed light assemblies: NFPA 80.
3. Corridor door assemblies shall be tested and listed per UL 1784.
4. Smoke Control Door Assemblies: Comply with NFPA 105.
  - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors
5. Install fire rated door assemblies in compliance with NFPA 80.

### 2.3 PERFORMANCE CRITERIA

- A. Exterior Openings: Comply ASTM C1363 for minimum thermal ratings. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
  1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
    - a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.29, R-Value 3.4, including insulated door, thermal-break frame and threshold.
      - 1) Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.36 and R-Value 2.7, including insulated door, kerf type frame, and threshold.
  2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
    - a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).

### 2.4 DOORS

- A. General: Refer to the Drawings for design of doors, sizes, glazing cut-outs in doors, and details.
- B. Construction: Full flush commercial type, 1-3/4 inches thick, unless noted otherwise, meeting or exceeding the materials, gages, construction, and testing requirements of the referenced ANSI and SDI publications.
  1. Exterior Door Core Construction: Manufacturer's standard vertical steel-stiffener core. Fabricate doors with specified R-value when tested according to ASTM C1363.
    - a. Exterior Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
  2. Interior Door Core Construction: Manufacturer's standard polystyrene core, or polyurethane core (at non-rated doors only).
    - a. Interior Fire Door Core: Mineral board core, as required to provide fire-protection and temperature-rise ratings indicated.

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- C. Interior Doors 1-3/4 inch thick (44.4 mm): ANSI 250.8, Level 2, Model 1 (Full Flush), ANSI A250.4 Physical Performance Level B, (Heavy Duty) having 18-gage, minimum 0.042 inch (1.0 mm) steel faces, with a minimum STC rating of 32.
    - 1. Fire-rated doors: Modify specified construction to meet all construction requirements required for fire-resistive rating.
      - a. Affix appropriate UL, FM or Warnock Hersey labels to each rated door, indicating applicable rating.
  - D. Exterior Doors: ANSI 250.8, Level 3, Model 2 (Seamless), ANSI A250.4 Physical Performance Level B, (Extra Heavy Duty) having 16-gage, 0.058 inch thick (1.46 mm) A60 galvanized steel faces, with a minimum core R-value of 6.25.
    - 1. Visible edge seams: weld edge seams and finish for seamless appearance (Model 2).
  - E. Removable Glazing stops: Rectangular channel sections, not less than 20-gage, 0.032 inch thick (0.8 mm) steel; pre-drilled and loosely attached within the glazing cut-outs with countersunk tamper-resistant stainless steel screws; sized to properly accommodate the designated thicknesses of glass and glazing materials; and external edges set flush with, or slightly behind, door face. Modify glazing stops for UL Label doors to conform with UL fire rating requirements.
  - F. Hardware reinforcing: Welded in place steel reinforcement, hot rolled pickled and oiled steel per ASTM A569. Provide G-60, hot-dipped galvanized reinforcing for all exterior openings, and locations where galvanized doors and frames are scheduled. Reinforcing shall be not less than the following minimum steel thicknesses:
    - 1. Hinges: 7 gage, minimum 0.167 inch (4.2 mm) thick.
    - 2. Closers: Box/channel-shape reinforcing, 12 gage, minimum 0.093 inch (2.3 mm) thick.
    - 3. Locks: Box/channel-shape reinforcing,
      - a. Cylindrical locks: 16 gage, minimum 0.053 inch (1.3 mm) thick.
      - b. Mortise locks: 14 gage, minimum 0.067 inch (1.6 mm) thick.
    - 4. Kick plates: 18 gage, minimum 0.042 inch (1.0 mm) thick.
    - 5. All other hardware: 14 gage, minimum 0.067 inch (1.6 mm) thick.
    - 6. Locations for reinforcing shall be determined from information and templates provided under Section 08 71 00 - DOOR HARDWARE.
  - G. Provide UL approved welded steel astragal at each UL pair of fire doors.
  - H. Fabrication
    - 1. Fabricate exposed faces of door panels from cold-rolled steel only.
    - 2. Fabricate concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel (at manufacturer's option).
    - 3. Fabricate doors with hardware reinforcement welded in place.
    - 4. Attach fire rated label to each door unit.
    - 5. Close top and bottom edge of exterior doors with flush end closure. Seal joints watertight.

6. Door undercuts: Maximum door undercut is 3/4 inches, coordinate with height of floor leveling and floor finishes.

## 2.5 HOLLOW METAL FRAMES

- A. General: Refer to the Drawings for various types of frames, sizes, and profiles, UL fire-resistive Label frames, and other characteristics of frames and related items.
  1. Frame type (all frames): Shop welded frames with mitered joints arc-welded, reinforced and ground smooth.
- B. Materials for frames, reinforcement, anchors, anchor clips and related items: commercial grade cold-rolled steel conforming to ASTM A109 or commercial grade hot-rolled and pickled steel conforming to ASTM A415.
  1. Frame gage:
    - a. Interior frames: 16-gage, 0.053 inch thick (1.3 mm), except as otherwise required for specific U.L. Label.
    - b. Exterior frames: 14-gage, 0.067 inch thick (1.7 mm), with an A60 zinc coating (galvannealed), supplied by the hot-dip process conforming to ASTM A653, Grade 37, with coating applied in accordance with A 924.
  2. Hinge reinforcement: 7 gage, minimum 0.167 inch (4.2 mm) thick.
  3. Lock and strike reinforcement: 12 gage, minimum 0.093 inch (2.3 mm) thick.
  4. Door closer reinforcement: 12 gage, minimum 0.093 inch (2.3 mm) thick.
  5. Floor clips: 16 gage, minimum 0.053 inch (1.3 mm) thick.
  6. Splice plates or channels: same gage as door frame.
  7. Removable Glazing stops: Rectangular channel sections, not less than 20-gage, 0.032 inch thick (0.8 mm) steel; pre-drilled and loosely attached within the glazing cut-outs with countersunk tamper-resistant stainless steel screws; sized to properly accommodate the designated thicknesses of glass and glazing materials; and external edges set flush with, or slightly behind, door face. Modify glazing stops for UL Label doors to conform with UL fire rating requirements.
  8. Plaster guards: 26 gage, minimum 0.016 inch (0.4 mm) thick.
  9. Mortar guards: 26 gage, minimum 0.016 inch (0.4 mm) thick.
- C. Frame construction:
  1. Fire-rated frame assemblies: Modify specified construction to meet all construction requirements required for fire-resistive rating.
    - a. Affix appropriate UL, FM or Warnock Hersey labels to each rated frame assembly, indicating applicable rating.
  2. Shop-fabricate frames as whole single units per door opening, except when frame size is too large to ship as a single unit. Oversized frames may be shipped in large sections as practicable for field assembly with concealed splice plates or channels.
    - a. Frame corner construction: Refer to paragraph A of this Article.
  3. Reinforcements, stiffeners, and base angle clips: Welded to interior surfaces of frames to provide a stable base and so as to not interfere with installation of hardware.

4. Provide plaster guards or mortar boxes, welded to frame, at back of hardware cut-outs where mortar or other materials may obstruct hardware operation.
5. Appearance of finished frames: Strong, rigid, completely free from warp and buckle, with miters well-formed and in true alignment, and with surfaces smooth and free from defects of any kind.
6. Silencer holes: Prepare frames for silencers at non-gasketed doors, coordinate with Section 08 71 00 – DOOR HARDWARE and Hardware Schedule. Provide three single silencers for single doors, and mullions of double doors on strike side. Provide two single silencers on frame head at double doors without mullions.
7. Glazing beads: Carefully place to properly accommodate the various thicknesses of glass and glazing materials, and loosely-attach to frames with flathead galvanized steel screws through pre-drilled holes having countersunk depressions.

D. Anchorage:

1. Anchor clips for frames in metal stud partitions: 16-gage (minimum 0.053 inch [1.3 mm] thick) steel z-shaped clips factory welded onto frame, 1-1/2 inch upturned and downturned legs, or equivalent type standard with the manufacturer, contained within the frames, for screw attachment to metal studs under Section 09 22 16 - NON-STRUCTURAL METAL FRAMING.
2. Anchors for frames in existing masonry walls: Counter-sunk bolts of minimum 3/8 inch diameter, set into masonry expansion shields.
  - a. Installed countersunk bolts to be filled with auto-body compound, and sanded smooth ready for field-applied touch-up primer and paint finish.
3. Anchors for fire-resistive rated frames: Conform to all UL requirements for the specific fire-resistive ratings.
4. Provide the following number of anchors, clips, or bolts, per jamb:
  - a. For frames 7'-6" in height or less: 3 anchors per jamb.
  - b. For frames 7'-6" in height or less and having doors exceeding 3'-0" feet width, and for cross corridor frames: 4 anchors per jamb.
  - c. For frames greater than 7'-6", up to 10'-0" in height: 4 anchors per jamb.
  - d. For frames greater than 7'-6", up to 10'-0" in height, and having doors exceeding 3'-0" feet width, and for cross corridor frames: 5 anchors per jamb.
  - e. For frames over 10'-0' in height: 5 anchors per jamb.

2.6 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Fabrication Tolerances, Maximum variation for doors and frames: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.

2.7 FINISHES

- A. Preparation: Pressure-sand all surfaces of all doors, frames, accessory items, anchors, and related items, to remove blemishes and foreign matter and provide

paint grip. Spot-fill imperfections with metallic filler, and sand smooth. Thoroughly clean the surfaces by applying hot or cold phosphate treatment standard with the manufacturer.

- B. Following cleaning apply one dip or spray coat of rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer to all surfaces, including those which will be concealed after erection. Bake, or oven dry, the primer at time and temperature recommended by the manufacturer for developing maximum hardness and resistance to abrasion.

### **PART 3 - EXECUTION**

#### **3.1 ERECTION AND INSTALLATION**

- A. Installation of frames and doors, including all accessories and related items furnished hereunder, will be performed under Section 08 05 13 – COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.
  - 1. Section 08 05 13 – COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION shall place frames in correct position within specified tolerances.
  - 2. All doors and frames: Space between door and frame shall not exceed 1/8 inch, including new doors installed into existing frames.
  - 3.
- B. Final installation of loosely-attached glazing stops will be performed under Section 08 80 00 - GLAZING.

End of Section

Section 08 14 16  
FLUSH WOOD DOORS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Provide the following products:
  - 1. Flush solid core wood doors, complete with necessary blocking, hardware cut-outs and openings field glazed where so indicated, installed under requirements of Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION: Remove designated portions of partitions as required to provide or enlarge for new door openings.
- D. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, and nailers; installation of steel door frames.
- E. Section 06 20 00 - FINISH CARPENTRY: Wood thresholds, frames, casing and trim; installation of doors and hardware.
- F. Section 08 05 13- COMMON WORK RESULTS – INSTALLATION DOORS AND HARDWARE.
- G. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Hollow metal frames scheduled to receive wood doors.
- H. Section 08 14 33 - STILE AND RAIL WOOD DOORS.
- I. Section 08 81 26 – INTERIOR GLASS GLAZING: Requirements for glazing in flush wood doors.
- J. Section 09 91 00 - PAINTING: Applied opaque finish coatings.

## 1.1 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
  2. ANSI A 208.1 - Wood Particleboard.
  3. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
  4. ASTM C 1036 - Flat Glass.
  5. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
  6. ASTM D 523 - Specular Gloss.
  7. ASTM D 5456 –Evaluation of Structural Composite Lumber Products..
  8. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
  9. Federal Safety Standards for Architectural Glazing Materials 16CFR1201.
  10. NFPA publication 80 - Fire Doors and Windows.
  11. WDMA Industry Standard IS 1A-13.
  12. UBC 43.2 – Fire Tests of Door Assemblies.
  13. UL 10B - Fire Tests of Door Assemblies.
  14. UL 10C – Positive Pressure Fire Door Test Method.
  15. Warnock-Hersey - Certification Listings for fire doors.
  16. All applicable federal, state and municipal codes, laws and regulations for exits.
- B. Definitions:
1. FSC: Forest Stewardship Council
  2. NAUF: No added Urea Formaldehyde.

## 1.2 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Fabricator's product data sheets, specifications, and performance data.
  2. Certification: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
    - a. General: Fabricator's written certification stating that doors, meet or exceed the requirements specified under this Section; that specified shop finishing has been performed; and that all fire-resistive requirements for the indicated Labels have been met.
    - b. Provide signed certification by agent of door manufacturer stating that machining, glazing and finishing of doors shall be performed by only by the manufacturer in its facilities.



- c. Chain-of-Custody: Written documentation providing evidence of compliance with Chain-of-Custody supply of wood products, and compliance with FSC standards.
  - 1) Demonstrate that products are FSC-certified by providing vendor invoices. Invoices will contain the vendor's chain of custody number and identify each chain of custody certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.
  - 2) Wood products lacking acceptable documentation will be rejected and their removal required.
- 3. Door schedule: All doors specified under this Section, coordinated with the both door and hardware schedules contained in the Contract Drawings.
  - a. Indicate doors to be factory finished and finish requirements.
  - b. Indicate fire protection ratings for fire rated doors.
- 4. Shop drawings: Elevations, and large scale sections and details of door construction, indicating profiles, core construction, joinery, edges, and cut-outs for hardware and glazing.
  - a. Indicate dimensions and locations of mortises and holes for hardware.
  - b. Indicate dimensions and locations of cutouts.
  - c. Indicate requirements for veneer matching.
- 5. Verification samples:
  - a. Corner section of specified flush type door, showing core construction and joinery.
  - b. For transparent finishes: submit two 8 by 10 inch mounted finished samples of each specie of veneer specified.
  - c. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.
  - d. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.
- 6. LEED Submittal Requirements:
  - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
    - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
      - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
      - b) EPD shall have at least Cradle to Gate scope,
    - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
    - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
      - a) Itemized vendor invoices for FSC-certified products.

- b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
- 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
- c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
  - 1) Recycled Content:
    - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
    - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
  - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
    - a) Documentation should be in the form of one of the following:
    - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
    - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
    - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
    - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
    - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
  - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (composite wood products):
  - 1) Provide manufacturers' product data confirming that the composite wood products in the building have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for composite wood products installed within the waterproofing membrane.

1.3 QUALITY ASSURANCE

- A. All materials and workmanship shall conform in all respects to the specified grades of the Window and Door Manufacturer's Association (WDMA) Industry Standard IS 1A-13, except as modified herein.
- B. Sole Source: Obtain doors specified in this Section from a single manufacturer.

1.4 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing wood doors.
- B. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
- C. Do not fabricate doors before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and approved by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

1.5 DELIVERY, STORAGE AND HANDLING

- A. The Contractor is responsible to make certain that wood doors are not delivered until the building and storage areas are sufficiently dry so that the doors will not be damaged by excessive changes in ambient humidity and relative moisture content.
- B. Deliver wood doors in resilient non-staining moisture-proof packaging, provide protection during transit and job storage. Clearly identify doors with door opening number, matching those indicated on the approved Door Schedule.
- C. Inspect doors upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
- D. Store doors flat on a level surface, in protected, elevated, dry areas; protect from exposure from all sources of light and moisture. When required to maintain manufacturer's warranty, seal top and bottom edges if stored more than one week. Break packaging seal on-site to permit ventilation.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period

1.7 FIELD MEASUREMENTS

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

1.8 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.

1. Manufacturer's Warranty: Provide coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction, all as defined by .
2. Warranty length:
  - a. Interior doors: Manufacturer's lifetime warranty.
3. Warranty coverage shall include all labor and material costs of delivery, re-hanging, re-finishing, glass and glazing to produce a complete installation of replaced or repaired doors.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products are limited to the following:
  1. Eggers Industries, (Division of VT Industries), Two Rivers WI.
  2. Graham Manufacturing (Division of Masonite Architectural), Mason City IA.
  3. Lambton Doors, Lambton Quebec Canada.
  4. Marshfield DoorSystems, Inc., (Division of Masonite Architectural.), Marshfield WI.
  5. VT Industries Inc., Holstein IA.

### **2.2 DESCRIPTION**

- A. General Description: Flush wood doors conforming to the requirements set forth in the designated Sections of the (WDMA) Industry Standard IS 1A-13, and the applicable requirements of U.S. Commercial Standard CS 171, as amended. Refer to the Drawings for sizes, locations of each type door, and other characteristics of doors to be furnished hereunder.
  1. All wood veneers and matching edging materials shall be "Chain-of-Custody" certified as FSC Certified.
  2. All particle board door cores are required to contain minimum 80 percent FSC Certified content.
  3. Door Grade: Custom.
  4. Door Facing:
    - a. Face veneer (transparent): WDMA Industry Standard, "A" Grade veneer minimum 1/50 inch (0.6 mm) thick, mechanically spliced.
      - 1) Wood Species and cut: As subsequently selected by Architect.
      - 2) Matching of adjacent pieces of veneer: book matched.
      - 3) Panel face assembly: Balanced.
    - b. Face veneer (opaque): MDO (Medium Density Overlay) face veneer, factory finished.
    - c. Crossbanding: Hardwood veneer or composite product at least 1/16 inch thick.
- B. Regulatory Requirements:

1. Fire rated door construction shall conform to UL publications 10B (neutral pressure testing) and 10C (positive pressure testing).
2. Install doors in compliance with NFPA publication 80.
3. Corridor door assemblies shall be tested and listed per UL 1784.

### 2.3 FIRE-RESISTANCE RATED 45, 60 AND 90 MINUTE LABEL DOORS

- A. General Construction: WDMA Industry Standard, Veneer, Fire Rated Mineral Core, Premium Grade Door.
1. Door thickness: 1-3/4 inches, unless indicated otherwise.
  2. WDMA Specification Descriptions.
    - a. 90 minute "B" label doors: Type "FD-90 MIN-5, HPDL".
    - b. 60 minute label doors: Type "FD-60 MIN-5, HPDL".
    - c. 45 minute "C" label doors: Type "FD-45 MIN-5, HPDL".
- B. Door facing: As specified herein above under Article 2.2, Paragraph A.
- C. Core construction:
1. Core: Fire resistant Non-combustible asbestos free, mineral composite material per label listing requirements. Positive pressure fire doors shall include intumescent when required, meeting UL Category A requirements..
  2. Stiles: multiple-ply stiles with 1/16 inch solid hardwood outer ply matching face veneers for species and color.
  3. Top and bottom rails: Maple, birch, Structural Composite Lumber (SCL) or UL approved composite material to meet label requirements.
  4. Blocking: Provide blocking as required to meet WDMA Extra Heavy Duty performance for securing surface applied hardware without the use of through bolts.
    - a. For doors scheduled to receive screw-mounted surface closers, provide top rail blocking.
    - b. For doors scheduled to receive surface mounted fire exit devices or vertical rods, provide top, intermediate and bottom rail blocking for screw mounting.
    - c. Provide additional blocking for all other surface mounted hardware.
- D. Adhesives: Type 1 (waterproof) for both face and core assembly.
- E. Accessories: For all fire-rated doors installed in pairs with both leaves active, provide 20-gage formed steel edges, without astragal, wrapped with veneer matching faces of doors.

### 2.4 FIRE-RESISTANCE RATED 20 MINUTE LABEL DOORS

- A. General Construction: WDMA Industry Standard, Veneer, Fire Rated Mineral Core, Premium Grade Door.
1. Door thickness: 1-3/4 inches, unless indicated otherwise.
  2. WDMA Specification Description: "FD-20 MIN".

- B. Door facing: As specified herein above under Article 2.2, Paragraph A.
- C. Core construction:
  - 1. Core: Structural Composite Lumber (SCL) engineered hardwood laminated strand board having no added Urea-Formaldehyde Resin and complying with ASTM D5456.
  - 2. Stiles: Stile construction that meets or exceeds WDMA Extra Heavy Duty performance. Structural composite lumber with minimum 1/2" hardwood outer stile of same specie as face veneer, minimum overall 1 inch after trimming
  - 3. Top and bottom rails: Maple, Birch, Structural Composite Lumber (SCL) or UL approved composite material to meet label requirements, minimum 7/8 inch width, after trimming.
- D. Adhesives: Type 1 (waterproof) for both face and core assembly.
- E. Accessories: For all fire-rated doors installed in pairs with both leaves active, provide 20-gage formed steel edges, without astragal, wrapped with veneer matching faces of doors.

## 2.5 NON-RATED SOLID-CORE DOORS

- A. General Construction: WDMA Industry Standard, Veneer, Particleboard Core Bonded, Premium Grade Door.
  - 1. WDMA Specification Description: "PC-5".
  - 2. Door thickness: 1-3/4 inches, unless indicated otherwise.
- B. Door facing: As specified herein above under Article 2.2, Paragraph A.
- C. Core construction:
  - 1. Core: Particleboard complying with ANSI A208.1 Type 1, Grade 1-LD-2 High density particleboard, minimum 37 pounds per cubic foot, which meets or exceeds WDMA Extra Heavy Duty performance requirement for face screw holding.
    - a. Provide only no added urea-formaldehyde particleboard. Furnish certification of formaldehyde free products.
  - 2. Stiles: Stile construction that meets or exceeds WDMA Extra Heavy Duty performance. Structural composite lumber with minimum 1/2" hardwood outer stile of same specie as face veneer, minimum overall 1 inch after trimming.
  - 3. Top and bottom rails: Maple, Birch, Structural Composite Lumber (SCL) or UL approved composite material to meet label requirements, minimum 7/8 inch width.
- D. Adhesives: Type 1 (waterproof) for both face and core assembly.

## 2.6 FLUSH WOOD FULL GLASS DOORS

- A. General Construction: WDMA Industry Standard, Veneer, Structural Composite Lumber Core Bonded, Premium Grade Door.
  - 1. WDMA Specification Description: "SHC-5".
  - 2. Door thickness: 1-3/4 inches, unless indicated otherwise.

- B. Openings for glazing: Only factory prepared glass doors will be accepted. Field-cutting of glazed openings is prohibited.
- C. Door facing: As specified herein above under Article 2.2, Paragraph A.
- D. Core construction:
  - 1. Core: Laminated strand lumber.
    - a. Acceptable alternative is Marshfield DoorSystems, DFJ-1 Core with reinforcement.
  - 2. Edge Bands: The stile edge bands shall be Solid edge bands or 4-ply edge band laminated to the core on four (4) sides per AWI 1300-G-3 Spec. Symbol PC-5 with Type II highly water-resistant glue, using the high frequency method. Four-ply rails of mill-option hardwoods shall be used. Solid edge bands or outer ply for stiles shall be hardwood matching face veneers for species and color.
  - 3. Top and bottom rails: Maple, birch or TimberStrand Laminated Strand Lumber, producing a smooth surface.
- E. Adhesives: Type 1 (waterproof) for both face and core assembly.
- F. Warranty: Manufacturer's standard Life Time Warranty.

## 2.7 GLAZING BEADS

- A. Glazing beads for 45, 60 and 90 minute fire rated doors: Manufacturer's standard veneer labeled bead, square profile with 5/8 inch sightline matching specified door facing wood species and cut with fire clip at rated doors, equal to VT Industries "Heritage Collection VTVLB or VT14 (114)".
- B. Glazing beads for 20 minute fire rated and non-fire rated doors: Manufacturer's standard hardwood bead, quarter round profile with 3/8 inch sightline matching specified door facing wood species and cut with fire clip at rated doors, equal to VT Industries "Heritage Collection VT9 (109)".
- C. Glazing tape: Preformed butyl-polyisobutylene rubber with 100 percent solids contained in extruded tape roll form and complying with AAMA 804.1.
- D. Setting blocks: Neoprene, 80-90 shore A durometer hardness.

## 2.8 FABRICATION

- A. Fabricate doors in accordance with specified manufacturer's requirements. Fabricated rated doors in compliance with WHI, or UL requirements as appropriate.
- B. Laminate door facing, cross banding and assembled core in a hot press.
- C. Bond stiles and rails to cores, sand for uniform thickness. Factory sand assembled door leaf.
- D. Factory-machine doors to receive hardware from templates furnished under Section 08 71 00 - DOOR HARDWARE. Do not machine for surface hardware.
  - 1. Provide inner blocks at lock edge and top of door for closer hardware reinforcement.

2. Cut and configure door edges to receive scheduled gasketting and intumescent edging specified under Section 08 71 00 – DOOR HARDWARE.
- E. Factory fabricate doors for undercut where scheduled.
- F. Factory cut all glazed openings as scheduled. Field cutting of openings is prohibited.
- G. Glazing: Provide as scheduled.
  1. Install glass in strict accordance with manufacturer's printed instructions.
  2. Install glazing bead with mitered corners.
  3. Countersink nails and fill holes with color matched putty.
- H. Fabrication tolerances: Maximum diagonal distortion (warp): 1/4 inch (6 mm) measured with straight edge from corner to corner over a maximum 42 by 84 inch surface area.

## 2.9 FACTORY FINISHING

- A. Transparent finish: WDMA Factory Finish System TR-6 Catalyzed Polyurethane having water based stain and ultraviolet (UV) cured polyurethane sealer and topcoat, with a satin sheen of 31° to 35° gloss units per ASTM D523.
  1. Finish system shall include the following:
    - a. Finish sanding.
    - b. Stain application.
    - c. Stain curing.
    - d. Sealer application - first coat.
    - e. Sealer gel cure.
    - f. Sealer application - second coat.
    - g. Sealer gel cure
    - h. Sealer application - third coat
    - i. Sealer full cure
    - j. Sealer sanding
    - k. Topcoat application - first coat
    - l. Topcoat application - second coat
    - m. Topcoat full cure
- B. Opaque finish: Shop applied AWS Premium Grade Factory Finish System 5, opaque conversion varnish system. in custom color matching Architect's control sample.
  1. Finish system shall include the following:
    - a. Finish sanding.
    - b. Wash coat vinyl. (for open grain wood species).
    - c. Filler. (for open grain wood species).
    - d. Vinyl Sealer application.
    - e. Topcoat application - first coat.
    - f. Topcoat application - second coat.



**PART 3 - EXECUTION**

3.1 INSTALLATION

- A. Installation of doors, including all accessories and related items furnished hereunder, will be performed under Section 08 05 13 – COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.
  - 1. All doors and frames: Space between door and frame shall not exceed 1/8 inch, including new doors installed into existing frames.
  - 2. Maximum under cut in doors is 3/4 inch, coordinate with floor leveling and floor finishes.

End of Section

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Section 08 14 33  
STILE AND RAIL WOOD DOORS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Provide stile and rail wood doors with flat panels, complete with hardware cut-outs and provided with openings for glazing and louvers, where so indicated, installed under requirements of Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.
  - 1. Provide stile and rail doors with transparent finish at scheduled locations.
  - 2. Provide stile and rail doors which are to receive field-painted finish at scheduled locations.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, and nailers.
- D. Section 06 20 00 - FINISH CARPENTRY: Wood thresholds, frames, casing and trim.
- E. Section 08 05 13- COMMON WORK RESULTS – INSTALLATION DOORS AND HARDWARE.
- F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Hollow metal frames scheduled to receive wood doors.
- G. Section 08 14 34 – CUSTOM FABRICATED STILE AND RAIL WOOD DOORS: stile and rail doors matching historic original doors.
- H. Section 08 81 26 – INTERIOR GLASS GLAZING: Requirements for glazing in flush wood doors.
- I. Section 09 91 00 - PAINTING: Applied opaque finish coatings.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.

Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
2. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
3. UL 1784 – Air Leakage Tests of Door Assemblies.
4. WDMA Industry Standard IS 1A-13.
5. Warnock-Hersey - Certification Listings for fire doors.
6. All applicable federal, state and municipal codes, laws and regulations for exits.

## 1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - Submittal Procedures:
1. Literature: Fabricator's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
  2. Certification: Fabricator's written certification stating that doors, meet or exceed the requirements specified under this Section; that specified shop finishing has been performed; and that all fire-resistive requirements for the indicated Labels have been met.
  3. Door schedule: A complete schedule of doors, to be furnished hereunder, coordinated with the schedule contained in the Contract Drawings.
  4. Shop drawings: Elevations, and large scale sections and details of door and frame construction, indicating profiles, joinery and cut-outs for hardware.
  5. Samples:
    - a. Corner section and panel of specified stile and rail type door exhibiting profile of panels, stiles and rails, and joinery.
    - b. For each specie of wood and finish scheduled for transparent finishes: submit two 12 inch long finished samples of each specie of wood specified, in the selected finishes.
    - c. After receipt of color selections from the Architect, submit 12 by 12 inch pieces of tempered hardboard, coated with the actual pigmented prefinishing system to be used, in each selected color.
  6. LEED Submittal Requirements:
    - a. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
      - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
        - a) Itemized vendor invoices for FSC-certified products.
        - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
      - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.

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- b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
- 1) Recycled Content:
    - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
    - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
  - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
    - a) Documentation should be in the form of one of the following:
    - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
    - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
    - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
    - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
    - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
  - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- c. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.

- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (composite wood products):
  - 1) Provide manufacturers' product data confirming that the composite wood products in the building have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for composite wood products installed within the waterproofing membrane.

#### 1.6 QUALITY ASSURANCE

- A. All materials and workmanship shall conform with Architectural Woodwork Institute (AWI) quality standards in grades as specified herein.
- B. Subject to compliance with the requirements specified herein, fabricators offering stile and rail doors which may be incorporated in the work must be AWI members in good standing.

#### 1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing wood doors.
- B. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
- C. Do not fabricate doors before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and approved by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. The Contractor is responsible to make certain that wood doors are not delivered until the building and storage areas are sufficiently dry so that the doors will not be damaged by excessive changes in ambient humidity and relative moisture content.
- B. Deliver wood doors in resilient non-staining moistureproof packaging, provide protection during transit and job storage. Clearly identify doors with door opening number, matching those indicated on the approved Door Schedule.
- C. Inspect doors upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
- D. Store doors in protected, elevated, dry areas; protect from exposure to sunlight and moisture. Seal top and bottom edges if stored more than one week. Break packaging seal on-site to permit ventilation.

#### 1.9 FIELD MEASUREMENTS

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

## 1.10 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
  - 1. Limited lifetime warranty for interior and exterior stile and rail doors.
  - 2. Provide written warranty agreeing to replace defective insulating glass units and stating that insulating glass units will be free from condensation, fogging and obstruction of vision due to film on internal surfaces for 10 years from date of installation. Replacement includes labor and materials.
- B. Warranties shall include delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following:
  - 1. Captiva Doors, Somerset MA.
  - 2. East Coast Custom Doors, South Portland ME.
  - 3. Eggers Industries, (Division of VT Industries), Two Rivers WI.
  - 4. Enjo Windows and Doors, Avenel NJ.
  - 5. Lambton Doors, Lambton Quebec Canada.
  - 6. Masonite Architectural, Tampa FL.
  - 7. Simpson Door Company, McCleary, WA.
  - 8. TruStile Doors, Inc. Denver CO.

### 2.2 INTERIOR (NON-HISTORIC) STILE AND RAIL DOORS

- A. General requirements: Conform to the requirements set forth in the designated Sections of the (WDMA) Industry Standard IS 1-A-97, (and the applicable requirements of U.S. Commercial Standard CS 171, as amended. Refer to the Drawings for sizes, locations of each type door, glazing cutouts in doors, and other characteristics of doors to be furnished hereunder.
  - 1. Construction: 1/3/4 inches thick, stile and rail doors with sticking and flat panel configurations as indicated on the Drawings as selected by the Architect from the manufacturer's full range of available profiles.
  - 2. Door Type F Panels (flat):
    - a. 1/2 inch thick flat panel, with mitered rim, tongue and grooved into edge of particle board panel. Miters reinforced with splines and glued under pressure.
    - b. Wood species veneer: Select White Maple (*Acer saccharum*) {sapwood}, Quarter Sliced.
    - c. Veneer 1/8 inch thickness before sanding.
  - 3. Door Type G Panels (raised):

- a. 1-1/2 inch thick raised panel, with mitered rim, tongue and grooved into edge of particle board panel. Miters reinforced with splines and glued under pressure.
  - b. Wood species veneer: White Oak (*Quercus alba*), Rift Sliced, MDO or match existing as scheduled.
  - c. Veneer 1/8 inch thickness before sanding.
4. Door Type H Panels (flat):
- a. 1/2 inch thick flat panel, with mitered rim, tongue and grooved into edge of particle board panel. Miters reinforced with splines and glued under pressure.
  - b. Wood species veneer: White Oak (*Quercus alba*), Rift Sliced, MDO or match existing as scheduled.
  - c. Veneer 1/8 inch thickness before sanding.
5. Stiles:
- a. Veneered stave core with matching edgebands.
  - b. Provide manufacturer's optional upgrade for bottom stile: Composite block material finger-jointed into the bottom of the stiles eliminates water infiltration, with manufacturer's 5-year warranty
6. Frames:
- a. Manufacturer's standard solid wood frame, single or double rabbeted as indicated on Drawings, with hardware cutouts to receive doors, prehung at factory.
- B. Performance Requirements, manufacturer's standard operating hardware utilized:
1. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F588.
- C. Hardware:
1. Anchor Bolts and Screws: Hex head through-bolts and flat head wood screws shall be of corrosion resistant type (zinc chromate, galvanized or stainless steel).
  2. Waterproof Adhesive: Resorcinol, melamine, or polyvinyl acetate emulsion type.
  3. Anchor Clips: Teco, Simpson Strong-Tie Connectors®, or approved equal.
  4. Operating Hardware: Refer to Section 08 71 00 – DOOR HARDWARE.
  5. Weatherstripping: Extruded ethylene propylene, neoprene or other plastic that remains flexible and non-sticky at project ambient temperature extremes.
- D. Wood Finish:
1. Exterior: All corners and edges of units receiving film-forming finishes shall be eased/radiused to promote finish adhesion and maintain proper film thickness.
    - a. One (1) coat factory primed, with additional finish coats applied in field after installation refer to Section 09 91 00 - PAINTING.

## 2.3 FABRICATION

- A. Fabricate doors to in dimensions, and profiles indicated in the drawings.



1. Tolerances: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.
- B. Factory machine doors for hardware specified and furnished under Section 08 71 00 – DOOR HARDWARE obtain templates prior to fabricating doors.

## 2.4 FACTORY FINISHING

- A. Transparent finish: WDMA Factory Finish System TR-6 Catalyzed Polyurethane having water based stain and ultraviolet (UV) cured polyurethane sealer and topcoat, with a satin sheen of 31° to 35° gloss units per ASTM D523.
  1. Finish system shall include the following:
    - a. Finish sanding.
    - b. Stain application.
    - c. Stain curing.
    - d. Sealer application - first coat.
    - e. Sealer gel cure.
    - f. Sealer application - second coat.
    - g. Sealer gel cure
    - h. Sealer application - third coat
    - i. Sealer full cure
    - j. Sealer sanding
    - k. Topcoat application - first coat
    - l. Topcoat application - second coat
    - m. Topcoat full cure
- B. Opaque finish: Shop applied AWS Premium Grade Factory Finish System 5, opaque conversion varnish system. in custom color matching Architect's control sample.
  1. Finish system shall include the following:
    - a. Finish sanding.
    - b. Wash coat vinyl. (for open grain wood species).
    - c. Filler. (for open grain wood species).
    - d. Vinyl Sealer application.
    - e. Topcoat application - first coat.
    - f. Topcoat application - second coat.
- C. Opaque doors for field applied finish: Prime doors with alkyd primer ready for field applied finish coatings.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Installation of doors, including all accessories and related items furnished hereunder, will be performed under Section 08 05 13 – COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.
  1. All doors and frames: Space between door and frame shall not exceed 1/8 inch, including new doors installed into existing frames.

2. Maximum under cut in doors is 3/4 inch, coordinate with floor leveling and floor finishes.
- B. Final installation of loosely-attached glazing stops will be performed under Section 08 80 00 - GLAZING.

End of Section

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Section 08 14 34

CUSTOM FABRICATED STILE AND RAIL WOOD DOORS AND FRAMES

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Provide custom fabricated interior and exterior stile and rail wood doors matching historic original doors, complete with hardware cutouts and provided with openings for glazing and louvers, where so indicated, installed under requirements of Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION..
  - 1. Exterior doors shall be fire rated (where indicated) and factory glazed Refer to Section 08 81 23 – EXTERIOR GLASS GLAZING for requirements for insulating glass.
  - 2. Interior doors shall be fire rated (where indicated) and factory glazed Refer to Section 08 81 26 – INTERIOR GLASS GLAZING for requirements for insulating glass.
  - 3. Coordinate rated door installation with fire rated wood frames as specified in Section 06 48 16 - FIRE RATED WOOD FRAMES.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, and nailers; installation of steel door frames.
- D. Section 06 48 16 – FIRE RATED WOOD FRAMES: Interior and exterior fire rated wood door frames.
- E. Section 08 05 13- COMMON WORK RESULTS – INSTALLATION DOORS AND HARDWARE.
- F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Hollow metal frames scheduled to receive wood doors.
- G. Section 08 14 33 – STILE AND RAIL WOOD DOORS: manufactured interior stile and rail doors.

- H. Section 08 81 23 – EXTERIOR GLASS GLAZING: Requirements for glazing in stile and rail wood doors.
- I. Section 08 81 26 – INTERIOR GLASS GLAZING: Requirements for glazing in stile and rail wood doors.
- J. Section 09 91 00 - PAINTING: Applied opaque finish coatings.

#### 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
  - 2. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
  - 3. UL 1784 – Air Leakage Tests of Door Assemblies.
  - 4. WDMA Industry Standard IS 1A-13.
  - 5. Warnock-Hersey - Certification Listings for fire doors.
  - 6. All applicable federal, state and municipal codes, laws and regulations for exits.

#### 1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - Submittal Procedures:
  - 1. Literature: Fabricator's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
  - 2. Certification: Fabricator's written certification stating that doors, meet or exceed the requirements specified under this Section; that specified shop finishing has been performed; and that all fire-resistive requirements for the indicated Labels have been met.
  - 3. Door schedule: A complete schedule of doors, to be furnished hereunder, coordinated with the schedule contained in the Contract Drawings.
  - 4. Shop drawings: Elevations, and large scale sections and details of door and frame construction, indicating profiles, joinery and cut-outs for hardware.
  - 5. Samples:
    - a. Corner section and panel of specified stile and rail type door exhibiting profile of panels, stiles and rails, and joinery.
    - b. For each specie of wood and finish scheduled for transparent finishes: submit two 12 inch long finished samples of each specie of wood specified, in the selected finishes.
    - c. After receipt of color selections from the Architect, submit 12 by 12 inch pieces of tempered hardboard, coated with the actual pigmented prefinishing system to be used, in each selected color.

1.6 QUALITY ASSURANCE

- A. All materials and workmanship shall conform with Architectural Woodwork Institute (AWI) quality standards in grades as specified herein.
- B. Subject to compliance with the requirements specified herein, fabricators offering stile and rail doors which may be incorporated in the work must be AWI members in good standing.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing wood doors.
- B. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
- C. Do not fabricate doors before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and approved by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

1.8 DELIVERY, STORAGE AND HANDLING

- A. The Contractor is responsible to make certain that wood doors are not delivered until the building and storage areas are sufficiently dry so that the doors will not be damaged by excessive changes in ambient humidity and relative moisture content.
- B. Deliver wood doors in resilient non-staining moisture proof packaging, provide protection during transit and job storage. Clearly identify doors with door opening number, matching those indicated on the approved Door Schedule.
- C. Inspect doors upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
- D. Store doors in protected, elevated, dry areas; protect from exposure to sunlight and moisture. Seal top and bottom edges if stored more than one week. Break packaging seal on-site to permit ventilation.

1.9 FIELD MEASUREMENTS

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

1.10 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
  - 1. Limited lifetime warranty for interior and exterior stile and rail doors.
  - 2. Provide written warranty agreeing to replace defective insulating glass units and stating that insulating glass units will be free from condensation, fogging and obstruction of vision due to film on internal surfaces for 10 years from date of installation. Replacement includes labor and materials.

- B. Warranties shall include delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering custom fabricated products which may be incorporated in the work include the following:
1. South Shore Millwork, Norton, MA.
  2. Captiva Doors, Somerset MA.
  3. Simpson Door Company, McCleary, WA.
  4. East Coast Custom Doors, South Portland ME.
  5. Enjo Windows and Doors, Avenel NJ.

### 2.2 EXTERIOR STILE AND RAIL DOORS

- A. General requirements: Conform to the requirements set forth in the designated Sections of the (WDMA) Industry Standard IS 1-A-97, (and the applicable requirements of U.S. Commercial Standard CS 171, as amended. Refer to the Drawings for sizes, locations of each type door, glazing cutouts in doors, and other characteristics of doors to be furnished hereunder.
1. Construction: 2-1/4 inches thick, solid wood doors with sticking and panel configurations as indicated on the Drawings matching existing doors.
  2. Panels:
    - a. Wood species: White Oak (*Quercus alba*) rift sawn (matching existing).
  3. Stiles:
    - a. Wood species: White Oak (*Quercus alba*) rift sawn (matching existing).
  4. Sticking: Solid oak, Match existing profiles and dimensions.
  5. Frames:
    - a. Custom solid wood frame, double rabbeted, with hardware cutouts to receive door and sidelights (interior doors only) pre-hung at factory.
    - b. Fire rated wood frames as specified in Section 06 48 16 - FIRE RATED WOOD FRAMES.
  6. Glue type: Type 1, PVA - waterproof.
  7. Fire ratings: As scheduled.
- B. Performance Requirements, manufacturer's standard operating hardware utilized:
1. Air Infiltration: Air leakage shall not exceed 0.15 CFM per square foot of surface area for fixed units and 0.30 CFM per foot of sash crack when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf.
  2. Water Infiltration: No uncontrolled leakage when tested in accordance with ASTM E547 at test pressure of 6.24 psf, or 20 percent of full positive design wind load, whichever is greater.
  3. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F588.

4. Thermal Transmittance: Provide door units with the following U-value as determined according to NFRC 100 or calculated according to LBNL Window 5.2 computer analysis.
    - a. U-value: Comply with Massachusetts State Building Code requirements.
  5. Structural Requirements: When tested in accordance with ASTM E330 at 150 percent of design pressure, no failure or permanent deflection in excess of 0.003 of any member's span after removing the imposed load, for a positive (inward) and negative (outward) design pressure of 60 psf.
- C. Hardware:
1. Anchor Bolts and Screws: Hex head through-bolts and flat head wood screws shall be of corrosion resistant type (zinc chromate, galvanized or stainless steel).
  2. Waterproof Adhesive: Resorcinol, melamine, or polyvinyl acetate emulsion type.
  3. Anchor Clips: Teco, Simpson Strong-Tie Connectors®, or approved equal.
  4. Operating Hardware: Refer to Section 08 71 00 – DOOR HARDWARE.
  5. Weatherstripping: Extruded ethylene propylene, neoprene or other plastic that remains flexible and non-sticky at project ambient temperature extremes.
- D. Wood Finish:
1. Exterior: All corners and edges of units receiving film-forming finishes shall be eased/radiused to promote finish adhesion and maintain proper film thickness.
    - a. One (1) coat factory primed, with additional finish coats applied in field after installation refer to Section 09 91 00 - PAINTING.

## 2.3 INTERIOR (HISTORIC) STILES AND RAIL DOORS

- A. Interior doors to match existing: Fabricate doors to AWI Premium Grade quality standards in manner to match existing, dimensions, materials, profiles, and finish of existing 1-3/4 inch thick doors. Provide doors with glazed openings where scheduled or indicated.
- B. Interior non-rated 1-3/4 inch thick custom fabricated stile and rail doors with two glazed lites, with shop applied transparent finish:
1. Construction: AWI Premium Quality Grade, and as follows:
    - a. Performance duty level: Extra Heavy Duty.
  2. Wood: AWI Premium Quality Grade.
    - a. Solid wood: White Oak (*Quercus alba*) rift sawn (matching existing).
    - b. Wood species: White Oak (*Quercus alba*) rift sawn (matching existing).
  3. Stiles and rails: Veneered stave core with matching edgebands. Veneer 1/8 inch thickness before sanding.
    - a. Stiles: 6 inch width.
    - b. Top, lock and intermediate rails: 6 inch width.
    - c. Bottom Rail: 12 inch width.
    - d. Mullions: None.
    - e. Verify height of lock rail with Architect.

4. Flat Bead Stops:, Clear without knots, matching door facings.
5. Glue type: Type 1, PVA - waterproof.
6. Glass, as scheduled and as specified under Section 08 81 26 – Interior Glass Glazing:
7. Finishing: AWI Premium Grade Factory Finish System: AWI System 9 – UV-curable, acrylated epoxy, polyester or urethane.
8. Fire ratings: As scheduled.

#### 2.4 FABRICATION

- A. Fabricate doors to in dimensions, and profiles indicated in the drawings.
  1. Tolerances: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.
- B. Factory machine doors for hardware specified and furnished under Section 08 71 00 – DOOR HARDWARE obtain templates prior to fabricating doors.

#### 2.5 FACTORY FINISHING

- A. AWI Premium Grade Factory Finish System “Conversion Varnish” system having a Medium rubbed effect with a sheen of 24° to 28° gloss units per ASTM D523. Finish system shall not substantially increase flame spread.
  1. One washcoat, reduced conversion varnish.
  2. Colorant, apply as required to match Architect’s control sample.
  3. One coat sealer, conversion varnish.
  4. Two coats topcoat: conversion varnish.
  5. Stain to match Architect’s sample.
- B. Opaque finish: Prime doors with alkyd primer ready for field applied finish coatings.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Installation of doors, including all accessories and related items furnished hereunder, will be performed under Section 08 05 13 – COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.
  1. All doors and frames: Space between door and frame shall not exceed 1/8 inch, including new doors installed into existing frames.
  2. Maximum under cut in doors is 3/4 inch, coordinate with floor leveling and floor finishes.
- B. Final installation of loosely-attached glazing stops will be performed under Section 08 80 00 - GLAZING.

End of Section



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Section 08 31 00  
ACCESS DOORS AND PANELS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Fire resistive rated and non-rated access panels and frames, as specified under this Section, furnished by Sections requiring the same and installed under the following Sections:
  - 1. Section 09 01 23 - PLASTER PATCHING AND REPAIR: Installation of access panels into plaster assemblies.
  - 2. Section 09 23 00 - GYPSUM PLASTERING: Installation of access panels into plaster assemblies.
  - 3. Section 09 29 00 - GYPSUM BOARD: Installation of access panels into drywall assemblies.
  - 4. Section 09 30 00 - TILING: Installation of access panels into tiled walls.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 03 30 00 – CAST-IN-PLACE CONCRETE.
- D. Section 09 01 23 - PLASTER PATCHING AND REPAIR: Installation of access panels into plaster assemblies.
- E. Section 09 29 00 - GYPSUM BOARD: Installation of access panels into drywall assemblies.
- F. Section 09 30 00 - TILING: Installation of access panels into tiled walls.
- G. Division 21 - FIRE SUPPRESSION: Furnishing access panels required for fire protection systems.
- H. Division 22 - PLUMBING: Furnishing access panels required for plumbing systems.
- I. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Furnishing access panels required for heating/cooling systems.

- J. Division 26 - ELECTRICAL: Furnishing access panels required for electrical systems.

#### 1.4 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications and installation instructions.
  2. Schedule: Submit Schedule of all access panels to be furnished hereunder, indicating locations for each size and type of access door.
    - a. The Contractor is responsible to ensure that all of the types/styles of panels and frames specified herein can be furnished by the manufacturer submitted.
    - b. Prior to submitting schedule, coordinate with the work of Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATING AND AIR CONDITIONING and Division 26 - ELECTRICAL and meet with the Architect to determine exact quantities and locations required for the installation of access panels.
  3. Shop drawings: Large scale details of access doors, indicating all sizes, gages and thickness; provide complete installation details, coordinated to the specific receiving conditions.
  4. Verification samples: 12 x 12 inch samples of each access panel illustrating material and finish. One sample to remain at Contractor's Site Office for the term of on-site work, for comparison to those being furnished.
  5. LEED Submittal Requirements:
    - a. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
      - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
        - a) The exposure scenario used to determine compliance.
        - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
        - c) Laboratory accreditation under ISO/IEC 17025.
        - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
      - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
      - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver access doors to the site, until all specified submittals have been submitted to, and approved by, the Architect.

- B. Store access door units inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  - 1. Acudor Products Inc., Cedar Grove, NJ
  - 2. Karp Associates Inc., Maspeth NY.
  - 3. Nystrom Products Company, Minneapolis MN.
  - 4. Williams Brothers Corporation of America, Front Royal, VA.
- B. Single Source: All work of this Section shall be produced by a single manufacturer, unless otherwise approved by the Architect.

### 2.2 ACCESS PANELS - GENERAL

- A. Minimum Access Door Sizes, based on access need:
  - 1. Reach-in access: Minimum size 12 by 12 inches.
  - 2. Body torso access: Minimum size 24 by 24 inches.
  - 3. Complete body passage: Minimum size 30 by 30 inches.
- B. Keying: All access panels shall be keyed alike; furnish Owner with 6 keys.

### 2.3 ACCESS PANELS - FOR FIRE RESISTANCE RATED CONSTRUCTION

- A. For fire-resistance rated wall and ceiling surfaces: Standard flush panel door meeting the following requirements:
  - 1. Panel and frame rating: UL "B" label for 90 minutes.
  - 2. Frame type:
    - a. For tiled walls: 16 gage Type 304 stainless steel flanged frame, with flange exposed to view 1 inch or less, equal to:
      - 1) Acudor FW-5050 series
      - 2) Karp KRP-150FR series.
      - 3) Nystrom IT series.
      - 4) Williams WB-FRSS Regular series.
    - b. For gypsum board walls and ceilings: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel drywall bead.
      - 1) Acudor FW-5050DW
      - 2) Karp KRP-350FR series.
      - 3) Nystrom IW series.
      - 4) Williams WB-FR series.
    - c. For plastered walls and ceilings: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel plaster bead.

- 1) Nystrom IP series.
3. Door: Insulated Flush panel door as follows:
  - a. Typical wall types : Flush door, Sandwich construction with 2 inch thick mineral wool fiber insulation between two layers of 20 gage galvanized bonderized steel.
  - b. For ceramic tile walls only: Flush door, Sandwich construction with 2 inch thick mineral wool fiber insulation between two layers of 20 gage Type 304 stainless steel.
4. Hinge: Flush continuous piano hinge with stainless steel pin.
5. Closer: Spring closer.
6. Lock: Latch bolt operated by recessed flush key.

#### 2.4 ACCESS PANELS - FOR NON- RATED CONSTRUCTION

- A. For non-rated wall and ceiling surfaces (service and non-public areas): Flush panel door type meeting the following requirements:
  1. Frame type:
    - a. For tiled walls: 16 gage Type 304 stainless steel flanged frame, with flange exposed to view 1 inch or less, equal to:
      - 1) Acudor UF-5000 series.
      - 2) Karp DSC-214SM series.
      - 3) Nystrom NT series.
      - 4) Williams WB-GP series.
    - b. For gypsum board walls and ceilings: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel drywall bead.
      - 1) Acudor DW-5040 series.
      - 2) Karp KDW series.
      - 3) Nystrom NW series.
      - 4) Williams WB-PL series.
    - c. For plastered walls and ceilings: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel plaster bead.
      - 1) Acudor PS-5030 series.
      - 2) Karp DSC-214PL series.
      - 3) Nystrom NP series.
      - 4) Williams WP-PL series.
  2. Door: Flush panel door as follows:
    - a. Typical all wall types, except tile: 14 gage galvanized bonderized steel.
    - b. For tiled walls: 14 gage type 304 stainless steel.
  3. Hinge:
    - a. Typical: Concealed spring hinge enabling door to open 175 degrees and permit removal of door from frame.
    - b. Panels greater than 24 by 36 inches: Flush continuous piano hinge with stainless steel pin.
  4. Lock: Latch bolt operated by recessed flush key.

- B. For non-rated gypsum board, walls and ceilings (Public areas): Recessed door type meeting the following requirements
  - 1. Manufacturer's types:
    - a. Acudor DW-5015 series.
    - b. Karp:
      - 1) Walls: Karp RDW series.
      - 2) Ceilings: Karp KATR series.
    - c. Nystrom RW series.
    - d. Williams WB-DW series.
  - 2. Frame type: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel drywall bead.
  - 3. Door: Recessed 16 gage galvanized bonderized steel door, with 22 gage galvanized steel drywall bead.
  - 4. Hinge: Concealed pivot rod hinge.
  - 5. Lock: Latch bolt operated by recessed flush key.
- C. For non-rated plastered walls and ceilings (Public areas): Recessed door type meeting the following requirements
  - 1. Manufacturer's types:
    - a. Acudor AP-5010 series
    - b. Karp DSC-210PL series.
    - c. Nystrom RP series.
    - d. Williams WB-AP series.
  - 2. Frame type: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel plaster bead with expanded lath.
  - 3. Door: Recessed 16 gage galvanized bonderized steel door, with self furring 3.4 pound galvanized steel lath welded to door.
  - 4. Hinge: Concealed pivot rod hinge.
  - 5. Latch: Latch bolt operated by recessed flush key.

## 2.5 ACCESSORIES

- A. Emergency latch release: For all ceiling panels and wall panels accessible from the back which are greater than 18 by 18 inches in size, provide an interior latch release mechanism to permit panel to be opened from back (interior side) of panel.

## 2.6 FACTORY FINISHING

- A. Panel assemblies fabricated from stainless steel: N<sup>o</sup>. 4 satin finish.
- B. Panel assemblies fabricated from galvanized bonderized steel: Baked on rust inhibitive gray primer finish.
- C. Panel assemblies fabricated from cold rolled steel: Phosphate dipped with baked on rust inhibitive gray primer finish.

**PART 3 - EXECUTION**

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that prepared openings are ready to receive the work of this Section and opening dimensions are as indicated on the shop drawings. Verify that all blocking is set in place and secure.
- B. Beginning of installation means acceptance of project conditions.

3.2 INSTALLATION

- A. Install access panels in accordance with manufacturer's instructions and direction from authorities having jurisdiction. Install miscellaneous specialties absolutely level and in true line, with units securely anchored to the surrounding construction.
- B. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.

End of Section

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Section 08 51 13  
ALUMINUM WINDOWS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Prefinished extruded, historic replica, aluminum window assemblies with fixed and outward opening, side hinged, operating sash including operating hardware, insect screening, and all angles, clips, and other items required to anchor the systems to the building structure.
  - 2. Prefinish extruded custom fabricated curved top doors at Unit 1 Terrace (scheduled as exterior door XNB-02).
  - 3. Prefinished miscellaneous formed aluminum mullion covers, closures, flashings, in conjunction with aluminum windows.
  - 4. Metal to metal sealing of aluminum assemblies.
  - 5. Insulated spandrel panels.
  - 6. All glass and glazing materials for aluminum windows, factory-installed to the fullest extent possible.
  - 7. Self-adhering, flexible flashing; including bonding cement, primers, and other components; at window openings.
  - 8. Perimeter sealant with backing materials at exterior side of windows.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing wall construction to receive work of this Section 08 51 13.
- D. Section 05 50 00 - METAL FABRICATIONS: Steel lintels.
- E. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.
- F. Section 07 21 00 - THERMAL INSULATION: Perimeter vapor and air seal between window frame and adjacent construction.

- G. Section 07 92 00 - JOINT SEALANTS: Interior perimeter sealant and back-up materials.
- H. Section 08 81 23 - EXTERIOR GLASS GLAZING: Requirements for glass and glazing types.
- I. Section 09 91 00 - PAINTING: Field painting of interior surface of infill panel and surfaces.

#### 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. AAMA 513 - Standard Laboratory Test Method for Determination of Forces and Motions Required to Activate Operable Parts of Operable Windows and Doors in Accessible Spaces.
  - 2. AAMA 1503.1 - Specification for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
  - 3. AAMA 2605 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
  - 4. ICC/ANSI A117.1-2017 Standard for Accessible and Usable Buildings and Facilities.
  - 5. ASTM A167 - Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet, and Strip.
  - 6. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
  - 7. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
  - 8. ASTM E283 - Rate of Air Leakage through Exterior Entrance and vestibule, Curtains Walls and Doors.
  - 9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 10. ASTM E330 Structural Performance of Exterior Entrance and vestibule, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  - 11. ASTM E331 - Test method of Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  - 12. ASTM E405 - Wear Testing Rotary Operators for Windows.
  - 13. ASTM E783 – Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
  - 14. ASTM E1105 – Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
  - 15. FS RR-W-356A - Wire Fabric.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:



1. AAMA/WDMA/CSA 101/I.S.2/A440-11 – *North American Fenestration Standard / Specification for Windows, Doors, and Skylights*, as amended (NAFS).
2. GANA - Glazing Manual (50<sup>th</sup> Anniversary edition).
3. Consumer Product Safety Commission (CPSC) 16CFR 1201 Code of Federal Regulations for Architectural Glazing Materials.

C. Definitions:

1. NAFS-11: Refers to North American Fenestration Standard / Specification for Windows, Doors, and Skylights, version referenced herein.

1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: for each window assembly type: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder, including but not limited to:
  - a. Window assemblies.
  - b. Glass and glazing materials.
  - c. Window hardware.
  - d. Flexible flashing and related primer and sealants.
  - e. Exterior perimeter sealant and backing materials.
  - f. Finish system.
2. Manufacturer's test data showing compliance with all specified performance requirements. Data shall be based on testing of windows units sized not less than those specified under the Article "Performance Requirements".
3. Manufacturer's installation instructions, indicate special precautions required.
  - a. Include written instructions for evaluating, preparing, and treating substrate for flexible flashing, sealants and general installation of windows.
  - b. Include environmental requirements and limitations.
4. Provide copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof. Additionally include the following:
  - a. Glass manufacturer's standard 10 year guarantee covering insulating glass.
5. Survey and Schedule of Existing Openings: A complete schedule of all existing window openings, measured on site. Indicate rough opening sizes, proposed window sizes and width of joint sealant required on all edges.
6. Shop drawings:
  - a. 1/4 inch scale elevations of each window.
  - b. Large scale design details of each window type; indicating sizes, types, and gauges of all metal components; glazing details, indicating types and thickness of glass; bracing and stabilizing members; attachment clips and brackets; and complete installation details;

- 1) For replacement glazing purposes, all windows are to be glazed from 'interior side' of windows. Detail and confirm on shop drawings.
- c. Furnish all details bearing dimensions of actual measurements taken at the project.
7. Selection Samples:
  - a. Provide three physical samples as requested by Architect for initial selection of colors and finishes, based on color range provided by Architect.
8. Verification samples:
  - a. Full size glazed window samples for Architect's review and approval prior to start of window fabrication, and prior to fabrication of Mock-up units. Approved samples will be maintained on site for comparison for Quality of Work.
    - 1) One casement window sample and muntins, with simulated divided lite glazing (Type GL-1 glass),.
    - 2) One fixed window sample glazed with lead caming (Glass Type GL-4).
  - b. Submit two samples of operating hardware.
  - c. Mock-up units specified under Article 1.6, may not be fabricated until receipt of Architect's review and approval of full sized samples submitted for Verification.
9. LEED Submittal Requirements:
  - a. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
    - 1) Recycled Content:
      - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
      - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
    - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
      - a) Documentation should be in the form of one of the following:
      - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
      - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
      - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.

- e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
- f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
- 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- b. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:
      - 0.5 mg/m<sup>3</sup> or less;
      - Between 0.5 and 5.0 mg/m<sup>3</sup>; or
      - 5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- B. Warranties: Submit warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.

#### 1.6 QUALITY ASSURANCE

- A. The aluminum window assemblies shall be by a single recognized manufacturer specializing in and regularly engaged in, the production of aluminum work of type and quality specified. The design and details as shown on the drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.
- B. Installer specializing in applying the work of this Section with a minimum of 3 years experience approved by product manufacturer.

#### 1.7 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 43 39 – MOCK-UPS.
- B. Provide mock-up of two window openings as directed, fully installed and demonstrating the minimum standard for the Work. Mock-ups to be reviewed and approved by Architect prior to installation of remaining windows.
  - 1. One casement window.
  - 2. One fixed window.

- C. Locate mock-ups where directed. Each mock-up installation shall be a complete weather-tight installation, tied to air/vapor barrier.
    - 1. Notify Architect and Owner's Representative one week in advance of mock-up installation to designated representative to observe window installation.
  - D. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.
    - 1. Protect mock-up from dust, soiling and damage until Project Substantial Completion.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Protect pre-finished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
  - B. Store framing and glazing materials in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
  - C. Sequence fabrication and deliveries to avoid delays in construction schedule, and to minimize time of on-site storage.
- 1.9 ENVIRONMENTAL CONDITIONS
- A. Do not install sealant when ambient temperature is less than 40 degrees Fahrenheit.
  - B. Maintain this minimum temperature during and after installation of sealant.
- 1.10 FIELD MEASUREMENTS
- A. Check dimensions of all existing openings by accurate field measurement; provide schedule and shop drawings as specified under Submittals (Article 1.5). Where practical check dimensions of new openings check actual in situ framing work, by accurate field measurement. Show recorded measurements on shop drawings. Do not fabricate windows until shop drawings and shop schedule is submitted and reviewed by Architect. Coordinate fabrication schedule with construction progress as directed by the Contractor. When it is necessary to proceed with the fabrication of window in new construction, without field measurements, coordinate and control installation tolerances to ensure proper fit of the work of this Section.
  - B. Verify that field measurements are as indicated on approved shop drawings.
- 1.11 SEQUENCING AND SCHEDULING
- A. Coordinate work of this Section with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
  - B. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of

any which are not. Do not proceed further until corrective work has been completed or waived.

## 1.12 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
1. Total window assemblies: Manufacturer's written warranty for aluminum windows, covering repair or replacement of any unit which leaks, or exhibits defects in materials, finish, design, for a period of 10 years from date of substantial completion of the General Contract.
  2. Insulating glass warranty: Glass manufacturer's 10 year written warranty covering insulating glass against defects in materials and workmanship, including failure of seals effective on date of original factory shipment to site.
    - a. Provide coverage in manufacturer's Guarantee for manufacturing defects, including failure of hermetic seal of air space (except by glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating or other visual indications of seal failure or performance.
    - b. Guarantee shall include replacement of defective glass and delivery of replacement glass furnished f.o.b. from point of manufacturer to project site.
  3. Insulated Metal Panels:
    - a. Lamination warranty: 25 years.
  4. Finish System Warranty: polyvinylidene flouride enamel finish 20 year coating warranty assigned specifically to project, covering film integrity (including chipping, crazing, pitting, and delamination), chalk resistance and color fading, color change.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Diamond Windows & Doors Manufacturing, Dorchester, MA, product "5000 Series Steel Replica".
- B. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work are limited to the following:
1. Diamond Windows & Doors Manufacturing, Dorchester, MA, product "5000 Series Steel Replica". (Basis of Design).
  2. Graham Architectural Products, York PA, product "GT6700".
  3. Saint Cloud Window, Sauk Rapids, MN., product "SCW3000"

### 2.2 PERFORMANCE REQUIREMENTS

- A. General: Design, fabricate, assemble and erect aluminum windows, and their interfacing conditions with contiguous work, to ensure continuity of building

enclosure vapor and air barriers and that all segments of the assemblies will be free from leakage under every condition of weather and exposure. In addition to the specified performance requirements, windows shall conform to, or exceed the requirements of the applicable building code and referenced industry standards for air infiltration, water infiltration, operating forces, deflection and deformation under load.

1. Glazing Requirement: All windows to be glazed from interior side of window.
- B. Testing Requirements: Provide manufacturer's testing and submit test data showing compliance with specified requirements for size of test units specified, or larger. Demonstrate compliance with specified requirements.
1. Manufacturer's standard data may be submitted if applicable. Perform specified testing if:
    - a. Manufacturer's standard data is based on window units smaller than those required.
    - b. Manufacturer's standard window units will be or have been modified to meet the specified requirements, including custom hardware, extrusions or other frame and sash components as indicated or specified herein.
    - c. Window units are of custom design.
  2. Test units: Provide window units for testing, fully glazed and assembled.
  3. Test Sequence: Air infiltration testing shall precede water resistance testing.
- C. Casement Windows (including related fixed sash):
1. General: Conform to requirements of AAMA/WDMA/CSA 101/I.S.2/A440-11 – *North American Fenestration Standard / Specification for Windows, Doors, and Skylights*, as amended, for minimum performance classification AW100, for air leakage, water drainage, water penetration, uniform structural loading, and further requirements of all of the following.
  2. Test samples:
    - a. Sample configuration: Figure Type A as defined in AAMA/WDMA/CSA 101/I.S.2/A440, Paragraph 2.2.5.4.
    - b. Sample(s) for air infiltration, water penetration and structural tests: Minimum unit size 5'-3" by 8'-0".
    - c. Sample(s) for thermal tests: Minimum unit size 4'-0" by 6'-0".
  3. Air infiltration through assembly, tested in accordance with ASTM E283 with a static pressure difference of 6.24 psf.
    - a. For operating sash, closed and locked, air infiltration shall not exceed 0.10 cfm per foot of sash crack length.
    - b. For fixed sash, air infiltration shall not exceed 0.10 cfm per square foot of window unit surface area.
  4. Water resistance: test in accordance with ASTM E331 and ASTM E547 at a static air pressure difference of 15.00 psf with result of no water leakage.
  5. Uniform structural loading: test in accordance with ASTM E330 at 1.5 times design test pressure, both positive and negative, acting normal to plane of wall with No glass breakage; permanent damage to fasteners, hardware parts, or anchors; damage to make windows inoperable; or permanent deformation of any main frame or ventilator member in excess of 0.2% of its clear span

(positive and negative) with result of no water leakage glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, or other damage which would cause the window to be inoperable.

6. Uniform load deflection: test in accordance with ASTM E330 at a static air pressure difference of 100 psf (positive and negative) with deflection not more than 1/175 of a window member's span.
7. Condensation resistance tests (CRF): conform to AAMA 1503 for a minimum CRF of 45.
8. Thermal transmittance tests: Conform to NFRC 100 for a maximum conductive thermal transmittance "U-Value" of U<sub>c</sub> 0.42.
9. Accessibility Performance: Test windows and operable hardware in accordance with test standard AAMA 513, demonstrating compliance with ICC/ A117.1.

D. Life Cycle Testing:

1. When tested in accordance with AAMA 910-10, there is to be no damage to fasteners, hardware parts, support arms, activating mechanisms or any other damage that would cause the window to be inoperable at the conclusion of testing.
  - a. Air infiltration and water resistance tests shall meet the primary performance requirements specified after completion of 4000 operational cycles plus thermal cycling.
  - b. Testing to previous, less stringent versions of AAMA 910 shall not be acceptable.

## 2.3 MATERIALS

- A. All fixed and operable window sections shall be of extruded aluminum. Formed brake metal work shall be of sheet aluminum. Alloys and temper of aluminum shall be as recommended by manufacturer for strength, corrosion resistant, and specified finish, but of not less than 22,000 psi ultimate tensile strength.
- B. Aluminum sections shall be factory prepared extrusions of sizes and profiles indicated on the approved shop drawing details; shall present straight, sharply defined lines and arises; and shall be free from defects impairing strength, durability, or appearance.
- C. Frames specified as thermally-broken shall be equipped with positive, continuous, polyvinyl chloride or polyurethane thermal barrier placed between exterior and interior frame components to the exterior of the glass pane.
  1. Frame depth: Calculation of specified frame depths shall not include screen tracks or sill extensions designed to accommodate screens.
- D. All screws, nuts, bolts, rivets and other fastening devices shall be of tempered aluminum or non-magnetic, type 302/304 stainless steel, compatible with the aluminum frame members and other components of the window systems. All such devices shall be of suitable type and adequate capacity for each intended purpose. The aluminum work shall generally be constructed and erected without use of exposed fasteners; where exposed fasteners must be used, the fasteners shall be finished to match the finish of surrounding aluminum.

1. Where fasteners screw-anchor into aluminum less than 0.125" thick, reinforce the interior with aluminum or non-magnetic stainless steel to receive screw threads, or provide standard non-corrosive pressed-in splined grommet nuts.
  2. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
- E. Sealant for use within the fabricated aluminum frames and for field sealing of the aluminum frame assemblies shall be type guaranteed by manufacturer for the joint size and movement to remain permanently elastic, non-shrinking and non-migrating.

## 2.4 STEEL REPLICA WINDOWS

- A. Frames/sash:
1. Frame to glass sightline:
    - a. Operable: 2-1/8 inch maximum within 1/4 inch tolerance, plus a frame extender.
    - b. Fixed: 1-5/8 inch maximum, plus a frame extender.
    - c. Frame Extender: 3/8 inch maximum.
  2. Frame profile to have a 'putty' profile.
  3. Frame and vent extrusion wall thickness: not less than 0.125 inch.
- B. Muntins: Size and profile as indicated on Drawings, in patterns indicated; mechanically fastened to frame or sash as appropriate to condition.
- C. Hardware:
1. Locking: Multi-point locking system.
  2. Locking handles, bases and strikes to be stainless steel in manufacturer's standard surface finish.
  3. Sash Limiter: 4 inch maximum opening.
  4. Concealed hinges: Stainless Steel.
  5. Roto operator.
    - a. Comply with AAMA 513, having minimum force opening requirements of less than 5 pounds operational force.
  6. Thermo-plastic or thermo-set plastic caps, housings and other components to be injection-molded nylon, extruded PVC, or other suitable compound.
  7. Weatherstripping: Double weather-stripped, "Santoprene" or equal.
- D. Sills: extruded aluminum, varies per location, refer to Drawings (A6.81 through A6.89).

## 2.5 INSULATED SPANDREL PANELS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Mapes Industries, Lincoln, NE, Product: "Mapes-R"
- B. Insulated Spandrel Panels: Laminated and insulated metal-faced flat panels.



1. Overall Panel Thickness: 1 inch.
  2. Exterior Skin: Aluminum, smooth faced 0.040 inch thick, "Custom Kynar" having custom color and finish matching window frame and sash.
    - a. Backing: 1/8 inch tempered hardboard.
  3. Interior Skin: Aluminum, smooth faced 0.040 inch thick, "Custom Kynar" having custom color and finish matching window frame and sash.
    - a. Backing: 1/8 inch tempered hardboard.
  4. Insulating Core: 2 pound density Polyisocyanurate closed cell foam.
    - a. R-Value: 6 per inch thickness.
- C. Surfacing-Burning Characteristics: Comply with ASTM E84; 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: 450 or less.
- D. Panel fabrication:
1. Tolerances - 0.8% of panels dimension length and width - (+/-) 1/16" thickness.

## 2.6 ALUMINUM BRAKE-METAL AND PANNING WORK

- A. Fabricate and install all extruded aluminum and formed sheet aluminum brake-metal work in conjunction with the aluminum window as detailed and as reasonably required to complete the work including sill extensions, snap trim pieces, jamb and sill trim, closures, coverings, flashings and other miscellaneous extruded and formed brake-metal work in conjunction with aluminum windows.
1. Provide extruded shapes wherever possible, reserving formed work for conditions where extrusions are not applicable.
  2. Provide sheet metal panning not less than 0.060 inch thick.
  3. Fasten trim clips, at not more than 16 inches on center.
- B. Factory fabricate sheet aluminum shadow box assembly for field installation, Refer to Drawing A6.85 for details.
1. Aluminum plate: 0.125 inch thickness, factory finished to match window framing.
  2. Plywood backing: 3/8 inch thick fire-resistant treated APA graded B C, Exposure 1, EXT, Group 1 species, 5 ply/5 layer plywood, touch-sanded. Install with "B" side exposed to interior.
  3. Factory drill ventilation holes, and perform touch up finishing.
  4. Fasteners: Type 304 Stainless Steel.
- C. Protect surfaces from marring when forming work. Provide sufficient material thickness with all necessary concealed reinforcement and anchorage to prevent "oil canning" or deformation of the finished work. Material deemed defective by the architect will be replaced at no cost to the Owner.

2.7 GLASS AND GLAZING MATERIALS

- A. Glass shall be of thickness and types scheduled in the Drawings as specified under Section 08 81 23.

2.8 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
1. Type and Location: Full, inside for project-out sashes.
- B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet or extruded aluminum.
  2. Frame color: Custom to match window frame and sash.
- C. Aluminum Wire Fabric Types:
1. Windows at Grade: 14 by 14 mesh of 0.016-inch- diameter, black vinyl coated aluminum wire.
  2. Windows above Grade: 18 by 16 mesh of 0.011-inch- diameter, black vinyl coated aluminum wire.

2.9 AIR BARRIER TRANSITION STRIPS

- A. Preformed Silicone-Sealant Extrusion / Transition Strip System: Manufacturer's standard preformed extruded pre-engineered pre-cured, low-modulus silicone-rubber extrusion, sized to fit opening widths, with a single-component, neutral-curing, 40 durometer. Class 100/50 (low-modulus) translucent silicone sealant for bonding extrusions to substrates, with a lock-in dart designed to fit pressure bar conditions
1. Basis of Design: Tremco Commercial Sealants & Waterproofing, Beachwood, OH. Product: "Proglaze ETA, System 3".
    - a. Width: As required by field conditions.
  2. Acceptable Products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    - a. Dow Corning Corporation, Midland MI., product: "123 Silicone Seal".
    - b. Momentive Performance Materials, Inc., (GE Silicones), Waterford NY., product: "US11000 UltraSpan".
    - c. Pecora Corporation, Harleysville PA., product: "Sil-Span".
    - d. Tremco Commercial Sealants & Waterproofing, Beachwood, OH. Product: "Proglaze ETA, System 3".
- B. Lap Sealant: Manufacturer's Two-part, elastomeric, trowel grade material designed for use with self-adhered membranes and tapes 10 g/l max. VOC Content.

1. Lap Sealant for terminations within 12 inches of fenestration assemblies to receive silicone sheet transition membrane:
2. Silicone sealant compatible with rubberized asphalt, and approved by both the sealant manufacturer and air barrier manufacturer for use as a lap sealant. Basis of design Dow 758 Silicone Weather Barrier Sealant.

#### 2.10 ACCESSORIES

- A. Sealant stop trim: Provide manufacturer's standard sealant stop trim at exterior perimeter of all window frames/trim.
- B. All anchors and fasteners, including screws, nuts, bolts, rivets, and other fastening devices shall be of tempered aluminum or non-magnetic type 302/304 stainless steel, warranted by the manufacturer to be non-corrosive and compatible with aluminum frame members and other components of the window assemblies. All such devices shall be of suitable type and adequate capacity for each intended purpose.
  1. Finished aluminum work shall generally be without use of exposed fasteners. Provide exposed fasteners only where acceptable to Architect, finish to match surrounding aluminum.
  2. For application of hardware, use fasteners that match finish of framing/sash member or hardware being fastened, as appropriate.
  3. Provide anchorage at location and spacing recommended by window manufacturer to comply with specified performance criteria.
  4. Shims: Provide non-organic, non corrosive fully concealed shims as required to level and plumb window assemblies. Locate shims where recommended by window manufacturer.
- C. Sealant and backing materials.
  1. General: Comply with Requirements of Section 07 92 00 - JOINT SEALANTS.
  2. For all non-structural system sealant joints, including exterior metal-to-metal weather seals: as recommended by manufacturer.
  3. For perimeter joints between system framing and abutting materials, including exterior metal-to-metal weather seals: Sealant type "SX" as specified under Section 07 92 00 - JOINT SEALANTS.
  4. For shadow box installation: Sealant type "SX" as specified under Section 07 92 00 - JOINT SEALANTS.
  5. Expanding foam sealant (as detailed): Sealant type FJS as specified under Section 07 92 00 - JOINT SEALANTS.

#### 2.11 FABRICATION

- A. Fabricate window units sized to properly fit each opening, allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
  1. Prepare window units ready to receive anchors, and furnished with all operating hardware.
  2. Engineer window units to fit the openings required without any cutting or fitting on the job site.

3. Rigidly fit joints and corner. Accurately fit and secure corners tight. Make corner joints flush, hairline, and weatherproof. Seal corner joints with sealant. Ensure that joining method(s) do not discolor or damage finish.
  4. Develop drainage holes with moisture pattern to exterior.
  5. Prepare components to receive anchor devices. Fabricate anchorage items.
  6. Permit internal drainage weep holes and channels to migrate moisture to exterior.
- B. Factory glaze to the greatest extent possible. "Wet-Glaze" work in accordance with GANA Glazing Manual SIGMA and LSGA standards for glazing and installations methods. Additionally:
1. For replacement glazing purpose, all windows are to be glazed from 'interior side' of windows, unless otherwise noted. Refer to Drawings for location of windows to be glazed from the 'exterior side' of windows.
  2. Prior to installing glass, clean glazing channels and framing members.
  3. Remove coatings not completely bonded to substrates.
  4. Remove lacquer from metal surfaces where in contact with glazing sealant.
  5. Protect glass from edge damage at all times. Utilize roller blocks and suction cups.
  6. Replace glass from edge damage or other imperfections which would weaken glass.
  7. Install setting and side blocks in locations recommended by referenced standards.
  8. Center glass in openings. Provide minimum bite and clearances as recommended by referenced standards. Install in manner to permit easy replacement of glass without dismantling frames.
  9. Prevent metal to glass contact at all locations. Protect edges of insulated units from moisture and solvents.
  10. Clean, prime and install stops.
- C. Assemble insect screens of rolled aluminum rectangular sections. Miter and reinforce frame corners. Fit mesh taut into frame and secure. Fit frame with four spring loaded steel pin retainers.
- D. Weatherstrip operable units as per Architectural Drawings.

## 2.12 FINISHES

- A. Factory Finish for Exposed Aluminum: Shop-applied Polyvinylidene Fluoride (PVDF) resin based, high performance thermoplastic organic coating conforming to AAMA 605.2, NAAMM - Metal Finishes Manual, and the following:
1. Resin base of 70 percent PVDF by weight, Atochem North America, Inc., product "Kynar 500" or Ausimont USA. product "Hylar 5000".
  2. Finish Coating shall be manufactured as one of the following products:
    - a. Morton International; product "Fluoroceram".
    - b. P.P.G. Industries Inc.; product "Duramar".
    - c. Valspar Corp., product: "Fluropon".

3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating, in accordance with Aluminum Association method AA-C12C42.
  4. Shop-prime all surfaces with a corrosion resistant, epoxy-based primer compatible with finish coating, averaging 0.2 to 0.4 mils dry film thickness, fully oven-cured.
  5. Shop finish with one color coat, of polyvinylidene fluoride enamel minimum 1.0 to 0.80 mil dry film thickness on all exposed surfaces, including all exposed screws, fastenings.
  6. Total system dry film thickness: 1.2 mils.
  7. Color and Appearance: Custom color to match Architect's Control Sample.
- B. Steel Items: Galvanized in accordance with ASTM A386 to 2.0 ounces per square foot.
- C. Isolation coating to cementitious and dissimilar materials: Apply one coat of bituminous paint or other acceptable coating to concealed aluminum surfaces in contact with cementitious and dissimilar materials
- D. Operator: Baked Thermo-set finish in custom color to match window frame and sash.
- E. Concealed Steel Items: Galvanized in accordance with ASTM A386 to 2.0 ounces per square foot.
- F. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Inspect all surfaces and verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.
- B. Beginning of installation means acceptance of existing conditions.

#### **3.2 INSTALLATION**

- A. Install aluminum windows in accordance with the manufacturers' installation instructions, and the herein-referenced standards.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Align windows plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.
- D. Install sill and sill end angles.
- E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

- F. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- G. Install operating hardware.
- H. Perform glazing work in accordance with GANA Glazing Manual SIGMA and LSGA standards for glazing and installations methods.
- I. Ensure that all metal-to-metal and metal-to-glass joints are completely weatherproof, and that adequate provisions have been made to permit expansion and contraction in the metal.
- J. No permanent exposed to view labels of any kind will be permitted to remain on frames or glass.
- K. Secure screens in place with tamper-proof fasteners.
- L. Install perimeter sealant to method required to achieve performance criteria. Sealant, backing materials, and installation criteria in accordance with Section 07 92 00 - JOINT SEALANTS.

### 3.3 TOLERANCES

- A. Maximum Variation from Level or Plumb: 0.06 inches every 3 feet non-cumulative or 1/16 inch per 10 feet, whichever is less.
  - 1. Do not add this tolerance to other allowable tolerances for related work.

### 3.4 FIELD QUALITY CONTROL

- A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
  - 1. Testing of unrepaired windows at (2) locations to be determined in the field to establish baseline testing/ functional requirements for replacement windows.
    - a. Air infiltration in accordance with ASTM E783 Standard Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors.
    - b. Static water penetration in accordance with ASTM E1105 – Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.
  - 2. Testing of Mockup windows at (2) locations, preferably the same location as the testing of the unrepaired window locations, to establish that repaired window will meet the functional requirements set for replacement windows.
    - a. Air infiltration in accordance with ASTM E783 Standard Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors.
    - b. Static water penetration in accordance with ASTM E1105 – Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.

3.5 ADJUSTING

- A. Adjust operable sash and hardware for smooth operation and tight fit of sash. Lubricate hardware and other moving parts.
- B. Touch-up all scratches, abrasions, and other defects in the prefinished metal surfaces with shop-coat finish material, supplied with the various items to be furnished hereunder.

3.6 CLEANING

- A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- B. Remove excess sealant by solvent acceptable to sealant manufacturer. All exposed edges of sealant and gaskets shall be left smooth, uniform in line, and with edges neatly struck.
- C. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess sealing compounds, mortar, paint, labels, dirt, and other contaminants.
- D. Remove protective material from prefinished aluminum surfaces. Wash down exposed surfaces free of dirt, handling marks, packing tapes, and foreign matter, using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.7 PROTECTION

- A. Protect finished metal surfaces from damage during fabrication, shipping, storage, and erection; advise the Contractor of protective treatment and other precautions required through the remainder of construction.
- B. Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Do not apply warning markings directly to the glass.
- C. Cover glass To protect it from activities that might abrade the glass surface.

3.8 GLASS BREAKAGE

- A. Repair Broken Glass:
  - 1. Replace in kind and thickness all glass breakage caused by the work performed under this Section, and bear all costs therefor.
  - 2. Replace in kind and thickness all glass breakage, caused by other trades, because of negligence or any other reasons, with the costs being borne by the trade at fault, or the Contractor, as applicable.

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SECTION 08 71 00

DOOR HARDWARE

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
1. Swinging doors.
  2. Sliding doors.
  3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
1. Mechanical door hardware.
  2. Cylinders specified for doors in other sections.
- C. Related Sections:
1. Division 06 Section "Rough Carpentry".
  2. Division 06 Section "Finish Carpentry".
  3. Division 08 Section "Hollow Metal Doors and Frames".
  4. Division 08 Section "Flush Wood Doors".
  5. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
  6. Division 28 Section "Access Control Hardware Devices".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  2. ICC/IBC - International Building Code.
  3. NFPA 70 - National Electrical Code.
  4. NFPA 80 - Fire Doors and Windows.
  5. NFPA 101 - Life Safety Code.
  6. NFPA 105 - Installation of Smoke Door Assemblies.
  7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
1. ANSI/BHMA Certified Product Standards - A156 Series
  2. UL10C – Positive Pressure Fire Tests of Door Assemblies

### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  - 3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
  - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  - 1. Function of building, purpose of each area and degree of security required.
  - 2. Plans for existing and future key system expansion.
  - 3. Requirements for key control storage and software.
  - 4. Installation of permanent keys, cylinder cores and software.
  - 5. Address and requirements for delivery of keys.
- G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
  - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors.

- Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  3. Review sequence of operation narratives for each unique access controlled opening.
  4. Review and finalize construction schedule and verify availability of materials.
  5. Review the required inspecting, testing, commissioning, and demonstration procedures
- H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

#### 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  1. Structural failures including excessive deflection, cracking, or breakage.
  2. Faulty operation of the hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
1. Ten years for mortise locks and latches.
  2. Twenty five years for manual surface door closer bodies.
  3. Five years for motorized electric latch retraction exit devices.
  4. Two years for electromechanical door hardware.

## 1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
  2. Where an alternate acceptable manufacturer is listed, comparable products may be submitted without a request for substitution. All non-listed manufacturers will require an approved request for substitution.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

## 2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.
    - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
  2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
  3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
  4. Hinge Options: Comply with the following:
    - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
  5. Manufacturers:
    - a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series. **Basis of design**
    - b. Hager Companies (HA)
    - c. Bommer Industries (BO)
- B. Invisible Hinges: Hinge completely mortised in door and jamb such that hinge is concealed when door is closed. Hardware is to be of type and design as specified and should comply with ANSI/BHMA A156.18.
1. Quantity: Provide the following hinge quantity:
    - a. Three Hinges: For doors with heights 61 to 90 inches.
  2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Interior Doors: High strength, plated steel and heavy duty, zinc allow castings.
    - b. Fire-rating: 20 minutes.
  4. Hinge options: Comply with the following
    - a. Non-removable Pins: Interpolated, laminated links connected with non-removable, riveted pins which provide moving pivot points and allow 180 degrees opening.
  5. Manufactures:
    - a. Soss; Universal Industrial Products Company, Inc (SOS) – Invisible Hinges. **Basis of design**
- C. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should comply with ANSI/BHMA A156.14.
1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.
  2. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.
  3. Manufacturers:
    - a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE). **Basis of design**

## 2.3 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
1. Manufacturers:
    - a. Securitron (SU) - EL-CEPT Series. **Basis of design**
- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.



1. Provide one each of the following tools as part of the base bid contract:
  - a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001. **Basis of design**
  - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003. **Basis of design**
2. Manufacturers:
  - a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series. **Basis of design**

## 2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
    1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
    2. Furnish dust proof strikes for bottom bolts.
    3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
    4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
    5. Manufacturers:
      - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO). **Basis of design**
      - b. Trimco (TC)
      - c. Door Controls international (DC)
      - d. Burns Manufacturing (BU)
  - B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
    1. Manufacturers:
      - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO). **Basis of design**
      - b. Ives (IV)
  - C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
    1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
    2. Flush Pulls: Size as indicated in hardware sets, secured with manufacturer's designated concealed fasteners as indicated in hardware sets.
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- a. Flush pull integrated with lock core; Sargent S2002C
  - b. Flush pull; Rockwood Products US26D
3. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
  4. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
  5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
  6. Manufacturers:
    - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO). **Basis of design**
    - b. Sargent Manufacturing (SA)
    - c. Ives (IV)

## 2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
  1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
  2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
  4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  5. Keyway: Match Facility Standard.
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
  1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware. Provide removable core (small or large format) as specified in Hardware Sets.
- E. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified cylinders employing a utility patented and restricted keyway requiring the use of patented controlled keys. Provide bump resistant, fixed core cylinders as standard with solid recessed cylinder collars. Cylinders are to be factory keyed where permanent keying records will be established and maintained.
  1. Provide a 6 pin multi-level master key system comprised of patented controlled keys and security and high security cylinders operated by one (1) key of the highest level.

Geographical exclusivity to be provided for all security and high security cylinders and UL437 certification where specified.

- a. Level 1 Cylinders: Provide utility patented controlled keyway cylinders that are furnished with patented keys available only from authorized distribution.
  - b. Level 2 Cylinders: Provide utility patented controlled keyway and side bar locking incorporating unique angled bottom pins for geographical exclusivity. Cylinders constructed to provide protection against bumping and picking.
  - c. Level 3 Cylinders: Provide utility patented controlled keyway and side bar locking incorporating unique angled bottom pins for geographical exclusivity. Cylinders to be UL437 certified and constructed to provide protection against bumping, picking, and drilling.
  - d. Refer to hardware sets for specified levels.
2. Manufacturers:
- a. Sargent Manufacturing (SA) - Degree Series. **Basis of design**
- F. Keying System: Each type of lock and cylinders to be factory keyed.
1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
  2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  3. Existing System: Field verify and key locks to match Owner's existing system.
- G. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Three (3).
  2. Master Keys (per Master Key Level/Group): Five (5).
  3. Construction Keys (where required): Ten (10).
  4. Construction Control Keys (where required): Two (2).
  5. Permanent Control Keys (where required): Two (2).
- H. Construction Keying: Provide temporary keyed construction cores.
- I. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  2. Provide transcript list in writing or electronic file as directed by the Owner.

## 2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
- B.
  1. All locking hardware shall include removable cores

2. Manufacturers:

- a. Sargent Manufacturing (SA) – 8200 Series. **Basis of design**

C. Cylindrical (Bored) Locksets. Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case

1. All locking hardware shall include removable cores.

2. Manufacturers:

- a. Sargent Manufacturing (SA) 10 Line. **Basis of design**

2.7 INTEGRATED WIEGAND OUTPUT LOCKING DEVICES – MULTI-CLASS READER

A. Integrated Wiegand Output Multi-Class Mortise Locks: Wiegand output ANSI A156.13, Grade 1, mortise lockset with integrated card reader, request-to-exit signaling, door position status switch, and latchbolt monitoring in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle trim, 3/4" deadlocking anti-friction latch, and 1" case-hardened steel deadbolt. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Latchbolt monitoring and door position switch act in conjunction to report door-in-frame (DPS) and door latched (door closed and latched) conditions.

2. Integrated reader supports the following credentials:

- a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.  
b. 13.56 MHz proximity credentials: HID iClass, HID iClass SE, SE for MIFARE Classic, DESFire EV1.

3. 12VDC external power supply required for reader and lock, with optional 24VDC lock solenoid. Fail safe or fail secure options.

4. Provide battery backup with all external power supplies.

5. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

6. Support end-of-line resistors contained within the lock case.

7. Installation requires only one cable run from the lock to the access control panel without requirements for additional proprietary lock panel interface boards or modules.

8. Installation to include manufacturer's access control panel interface board or module where required for Wiegand output protocol.

9. Manufacturers:

- a. Sargent Manufacturing (SA) – M1 8200 Series. **Basis of design**

## 2.8 AUXILIARY LOCKS

- A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.
1. Manufacturers:
    - a. Sargent Manufacturing (SA) - 4870 Series. **Basis of design**

## 2.9 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
  4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
  2. Strikes for Bored Locks and Latches: BHMA A156.2.
  3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
  4. Dustproof Strikes: BHMA A156.16.

## 2.10 ELECTROMAGNETIC LOCKING DEVICES

- A. Surface Electromagnetic Locks (Heavy Duty): Electromagnetic locks to be surface mounted type conforming to ANSI A156.23, Grade 2 with minimum holding force strength of 1,200 pounds. Locks to be capable of accepting between 12 to 24 volts direct current and be UL listed for use on fire rated door assemblies. Electromagnetic coils are to consume no more than 1.5W during normal operation. Locks are to have an integrated door position switch, tamper switch, and lock bond sensor. Locks are to have integrated motion sensor and/or security camera as indicated in the hardware sets. Locks to be capable of detecting door prop conditions and entering low power mode. Provide mounting accessories as needed to suit opening conditions. Power supply to be by the same manufacturer as the lock with combined products having a lifetime replacement warranty. Power supply to include battery backup for a minimum 12 hour run time.
1. Manufacturers:
    - a. Securitron (SU) – M680E Series. **Basis of design**

## 2.11 ELECTRIC STRIKES

- A. Standard Electric Strikes: Heavy duty, cylindrical and mortise lock electric strikes conforming to ANSI/BHMA A156.31, Grade 1, UL listed for both Burglary Resistance and for use on fire rated door assemblies. Stainless steel construction with dual interlocking plunger design tested to exceed 3000 lbs. of static strength and 350 ft-lbs. of dynamic strength. Strikes tested for a minimum 1 million operating cycles. Provide strikes with 12 or 24 VDC capability and supplied standard as fail-secure unless otherwise specified. Provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike where specified.
1. Manufacturers:
    - a. HES (HS). **Basis of design**
    - b. Von Duprin (VD)

## 2.12 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
  2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
  3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
  4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
  5. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
  6. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
  7. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

- a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
  - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
8. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
  9. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
  10. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  11. Extended cycle test: Devices to have been cycle tested in ordinance with ANSI/BHMA 156.3 requirements to 9 million cycles.
  12. Rail Sizing: Provide exit device rails factory sized for proper door width application.
  13. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
    - a. Sargent Manufacturing (SA) - 80 Series. **Basis of design**
    - b. Von Duprin (VD) – 35A/98 XP series
    - c. Stanley Precision (PR) – Apex 2000 series
- 2.13 INTEGRATED WIEGAND OUTPUT EXIT DEVICES – MULTI-CLASS READER
- A. Integrated Wiegand Output Multi-Class Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated proximity card reader, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.
1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
  2. Integrated reader supports the following credentials:
    - a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
    - b. 13.56 MHz proximity credentials: HID iClass, HID iClass SE, SE for MIFARE Classic, DESFire EV1.
  3. 12VDC external power supply required for reader. 24VDC required for solenoid operated exit trim. Fail safe or fail secure options.

4. Provide battery backup (min 12 hour run time) with all external power supplies.
5. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
6. Competitor Alternates Allowed Option: Installation to include manufacturer's access control panel interface board or module where required for Wiegand output protocol.
7. Manufacturers:
  - a. Sargent Manufacturing (SA) – M1 80 Series. **Basis of design**
  - b. Von Duprin (VD)
  - c. Stanley Precision (PR)

## 2.14 DOOR CLOSERS

### A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

### B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:



- a. Sargent Manufacturing (SA) - 351 Series. **Basis of design**
- b. LCN Closers (LC) – 4040XP series

## 2.15 ELECTROMECHANICAL DOOR OPERATORS

- A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.
  - 1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
- B. Standard: Certified ANSI/BHMA A156.19.
- C. Performance Requirements:
  - 1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
  - 2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.
- D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.
- E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19.
- F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.
- G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.
- H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.
- I. Wireless & wired Interface: Operator units shall have a wireless interface via a mobile device for ease of installation and setup. Control buttons and connection to other hardware elements such as locks shall be hard wired.
- J. Power supplies: Provide manufacturer's standard power supply with integral battery backup for all operators.
- K. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Norton Door Controls (NO) - 6300 Series.
2. LCN Automatic operator (LC) 4640 series **Basis of design**

## 2.16 ARCHITECTURAL TRIM

### A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
  - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
  - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO). **Basis of design**
  - b. Burns Manufacturing (BU)
  - c. Trimco (TC)

## 2.17 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  1. Manufacturers:
    - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO). **Basis of design**

- b. Burns Manufacturing (BU)
- c. Trimco (TC)

## 2.18 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
  - 1. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE). **Basis of design**
  - 2. National Guard Products (NG)
  - 3. Reese Enterprises (RS)

## 2.19 ELECTRONIC ACCESSORIES

- A. Push-Button Switches: Industrial grade momentary or alternate contact, back-lighted push buttons with stainless-steel switch enclosures. 12/24 VDC bi-color illumination suitable for either flush or surface mounting.
  - 1. Manufacturers:
    - a. Securitron (SU) - PB Series. **Basis of design**
    - b. Sentrol (SO)
- B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design

complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

- a. Securitron (SU) - DPS Series. **Basis of design**
- b. Sentrol (SO)

- C. Wiegand Test Unit: Test unit verifies proper Wiegand output integrated card reader lock installation in the field by testing for proper wiring, card reader data integrity, and lock functionality including lock/unlock, door position, and request-to-exit status. 12 or 24VDC voltage adjustable operating as Fail Safe or Fail Secure.

1. Manufacturers:

- a. Sargent Manufacturing (SA) – WT2 Wiegand Test Unit. **Basis of design**
- b. Sentrol (SO)

## 2.20 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.21 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch-Out Report): Reference Division 01 Section "Closeout Procedures". Final inspect installed door hardware and state in report whether work complies with or deviates from specification requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- B. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- C. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

<b>Set C-1 – Student kitchen / fire rated</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Restroom lock	8216 LNL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO
1 Threshold	By tile flooring	

<b>Set C-2 – Single / Access control / fire rated /acoustical</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Elec lock	M1-82271-24V-BIPS-B-OE-LNL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO
1 Power transfer	EL-CEPT	SU
2 wiring harness	QC-C – lengths as required	MK
1 Door contact	DPS	SE
* Gasketing	S773BL	PE
1 Sweep	209DV	PE
1 Threshold	2716A	PE

\* Full height of both jambs, full length of head.

**Sequence:** Door closed & locked at all times. Presenting valid credential (pull side) shunts door position switches & allows for authorized entrance. Push side free at all time for immediate egress. Operating push side trim activates request to exit switch in lock shunting door position switch and allowing authorized egress. With loss of power or activation of building fire system door remains locked. Passage without either activating RX switch (push) or valid credential read (pull) reports an alarm to the security system.

<b>Set C-3 – Student Laundry</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Restroom lock	8216 LNL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO

1 Sweep	209DV	PE
1 Threshold	2716A	PE
1 Magnetic hold open	996	RF

**Sequence** – Door held open on magnetic hold open under normal circumstances. Hold open to release on fire alarm. Door may be closed and manually locked w/ maintenance key to secure room for maintenance or cleaning.



<b>Set C-4– Double card control / Bike Room</b>		<b>612 UON</b>
6 Hinge	as required	MK
1 Elec lock	RX 8271-24V LNL	SA
2 Closer	351 UO	SA
2 Kick plate	K1050x6"	RO
2 Wall stop	406	RO
1 Coordinator	2600	RO
1 Auto bolts	2842	RO
2 Sweep	209DV	PE
1 Threshold	2716A	PE
1 Power transfer	EL-CEPT	SU
2 wiring harness	QC-C – lengths as required	MK
1 Position switch	DPS	SU
1 Prox reader	By electrical	

**Sequence:** Door closed & locked at all times. Presenting valid credential (pull side) shunts door position switches & retracts latch for authorized entrance. Push side free at all time for immediate egress. Operating push side trim activates request to exit switch in lock shunting door position switch and allowing authorized egress. With loss of power or activation of building fire system door remains locked. Passage without either activating RX switch (push) or valid credential read (pull) reports an alarm to the security system.

<b>Set C-4.1– Single card control / Bike Room / ADO</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Exit Device	12 55 56 8804 PTB 814	SA
1 Operator	4642 REG	LC
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO
1 Sweep	209DV	PE
1 Threshold	2716A	PE
2 Actuator	CM45xWT	Camden
1 Power transfer	EL-CEPT	SU
2 wiring harness	QC-C – lengths as required	MK
1 Position switch	DPS	SU
1 Prox reader	By electrical	

**Sequence:** Door closed & locked at all times. Presenting valid credential (pull side) activates ADO, unlatches lockset, and shunts DPS and allows for authorized ingress. Ingress manually or by actuating ADO. Activating RX in push bar, or utilizing interior ADO actuator shunts DPS and allows for authorized egress. Door always available for immediate egress via exit device. Using interior ADO actuator will shunt DPS, retract latchbolt, and swing door. With loss of power or activation of building fire system door remains locked. Passage without either activating RX switch (push), activating interior ADO actuator (push) or valid credential read (pull) reports an alarm to the security system.

<b>Set C-5 Cross-corridor or Lounge door</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Exit Device	12-8815-ETL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Magnetic hold open	996	RF

**Sequence** – Door held open on magnetic hold open under normal circumstances. Hold open to release on fire alarm.

<b>Set C-5.1 Cross-corridor door</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Exit Device	12-8815-ETL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO

**Set C-5.2 Suite entry/hold open** **612 UON**

3 Hinge	as required	MK
1 Passage Set	10U15-LL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Mag Hold	996	RF

**Sequence** – Door held open on magnetic hold open under normal circumstances. Hold open to release on fire alarm.

**Set C-6– Single / Secured zone access/ card control / Fire rated** **612 UON**

3 Hinge	as required	MK
1 Exit Device	12LD-M1-55-56-8804 BIPS B OE ETL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO
1 Power transfer	EL-CEPT	SU
2 wiring harness	QC-C – lengths as required	MK

**Sequence:** Door closed & locked at all times. Presenting valid credential (pull side) shunts integrated door position switches & allows for authorized entrance. Push side free at all time for immediate egress. Operating push side trim activates request to exit switch in lock shunting integrated door position switch and allowing authorized egress. With loss of power or activation of building fire system door remains locked. Passage without either activating RX switch (push) or valid credential read (pull) reports an alarm to the security system.

**Set C-7– Single / Vestibule interior / passage / ADO** **612 UON**

3 Hinge	as required	MK
1 Exit Device	12LD 55 56 8815-ETL	SA
1 Auto Operator	4642 REG	LC
2 Actuator	CM45xWT	Camden
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO
1 Power transfer	EL-CEPT	SU
2 wiring harness	QC-C – lengths as required	MK

**Sequence:** Door closed at all times. Pressing either actuator retracts latchbolt and after 1 second delay, swings door. Interior (push side) panic device always free for egress, exterior (pull side) trim always free for ingress.

**Set C-7.1– Single / Vestibule interior / passage** **612 UON**

3 Hinge	as required	MK
1 Exit Device	12-8815-ETL	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO

**Set C-7.2– Modified existing vestibule** **606 UON**

Remove latchbolt from lock body to permit door to swing freely. All other hardware existing to remain.

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<b>Set R-1 – Bathroom / multi occupant / fire rated</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Restroom lock	8216 LNL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO
1 Threshold	By tile flooring	

<b>Set R-2 – Bathroom / single occupant / fire rated</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Dorm lock/indicator	V50 8225 LNL-LB	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO
1 Threshold	By tile flooring	

<b>Set R-3 – Student room / fire rated</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Dorm lock	8225 LNL-LB	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO

(ALTERNATE OPTION – OMIT CLOSER, REPLACE HINGES WITH SPRING HINGES)

<b>Set R-3.1 – Student room / non-rated</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Dorm lock	8225 LNL-LB	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO

<b>Set R-4 – Single / Access control / fire rated</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Elec lock	M1-82271-24V-BIPS-B-OE LNL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO
* Gasketing	S773BL	PE
1 Power transfer	EL-CEPT	SU
2 wiring harness	QC-C – lengths as required	MK
1 Sweep	209DV	PE
1 Threshold	2716A	PE

\* Full height of both jambs, full length of head.

(ALTERNATE OPTION – OMIT CLOSER, REPLACE HINGES WITH SPRING HINGES)

**Set R-10 – In-Unit Bathroom** **612 UON**

3 Hinge	as required	MK
1 Privacy set	10U65-LL	SA
1 Wall stop	406	RO
1 Threshold	By tile flooring	

**Set R-11 – In-Unit Bedroom** **612 UON**

3 Hinge	as required	MK
1 Privacy set	10U65-LL	SA
1 Wall stop	406	RO

**Set R-12 – In-Unit Closet pair** **612 UON**

6 Hinge	as required	MK
2 Dummy trim	10U93	SA
2 Wall stop	406	RO
2 Roller catch	3594	RO

**Set R-13 – In-Unit Closet single** **612 UON**

3 Hinge	as required	MK
1 Passage set	10U15-LL	SA
1 Wall stop	406	RO

<b><u>Set S-1– Single / Stair access / card control / Fire rated</u></b>			<b><u>612 UON</u></b>
3 Hinge	as required		MK
1 Exit Device	12LD-M1-55-56-8804 BIPS B OE ETL		SA
1 Closer	351 UO		SA
1 Kick plate	K1050x6"		RO
1 Wall stop	406		RO
1 Power transfer	EL-CEPT		SU
2 wiring harness	QC-C – lengths as required		MK

**Sequence:** Door closed & locked at all times. Presenting valid credential (pull side) shunts integrated door position switches & allows for authorized entrance. Push side free at all time for immediate egress. Operating push side trim activates request to exit switch in lock shunting integrated door position switch and allowing authorized egress. With loss of power or activation of building fire system door remains locked. Passage without either activating RX switch (push) or valid credential read (pull) reports an alarm to the security system.

<b><u>Set S-2 – Single / Stair passage / Fire rated</u></b>			<b><u>612 UON</u></b>
3 Hinge	as required		MK
1 Exit Device	12-8815-ETL		SA
1 Closer	351 UO		SA
1 Kick plate	K1050x6"		RO
1 Wall stop	406		RO

<b><u>Set S-2.1 – Single / Stair passage / Fire rated / holder</u></b>			<b><u>612 UON</u></b>
3 Hinge	as required		MK
1 Exit Device	12-8815-ETL		SA
1 Closer	351 UO		SA
1 Kick plate	K1050x6"		RO
1 Wall stop	406		RO
1 Door Holder	996		RF

**Sequence** – Doors held open on magnetic hold open under normal circumstances. Hold open to release on fire alarm.

<b><u>Set S-3– Double / stair interior / Secure</u></b>			<b><u>612 UON</u></b>
6 Hinge	as required		MK
2 Exit Device	12 NB8713-ETL	SA	
2 Kick plate	K1050x6"		RO
2 Wall stop	406		RO

<b><u>Set S-4– Double / stair interior / passage</u></b>			<b><u>612 UON</u></b>
6 Hinge	as required		MK
2 Exit Device	12 NB8715-ETL	SA	
2 Kick plate	K1050x6"		RO
2 Wall stop	406		RO
2 Door holder	996		RF

**Sequence** – Doors held open on magnetic hold open under normal circumstances. Hold open to release on fire alarm.

<b>Set S-5– Uneven pair stair ingress</b>			<b>612 UON</b>
6 Hinge	as required		MK
1 Exit Device	LD-8804-ETL	SA	
2 Closer	351 UO		SA
2 Kick plate	K1050x6”		RO
2 OH stop	1-X36		RF
1 Threshold	2716A		PE
1 Coordinator	2600		RO
1 Auto Bolts	2842		RO

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**Set U-1 – Single Storage / Janitor closet rated / self closing** **612 UON**

3 Hinge	as required	MK
1 Lockset	8204-LNL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO

**Set U-1.1 – Single Storage / Janitor closet non-rated** **612 UON**

3 Hinge	as required	MK
1 Lockset	8204-LNL	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO

**Set U-2– Double storage closet rated / self closing** **612 UON**

6 Hinge	as required	MK
1 Lockset	8204-LNL	SA
2 Closer	351 UO	SA
2 Kick plate	K1050x6"	RO
2 Wall stop	406	RO
1 Coordinator	2600	RO
1 Auto bolts	2842	RO

**Set U-2.1– Double storage closet non-rated** **612 UON**

6 Hinge	as required	MK
1 Lockset	8204-LNL	SA
2 Kick plate	K1050x6"	RO
2 Wall stop	406	RO
1 Flush Bolts	557	RO

**Set U-3 – Single Mechanical / rated / self closing** **612 UON**

3 Hinge	as required	MK
1 Lockset	8204-LNL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO
* Gasketing	S773BL	PE
1 Sweep	209DV	PE
1 Threshold	2716A	PE

\* Full height of both jambs, full length of head.



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**Set U-4– Double Mechanical / rated / self closing** **612 UON**

6 Hinge	as required	MK
1 Lockset	8204-LNL	SA
2 Closer	351 UO	SA
2 Kick plate	K1050x6"	RO
2 Wall stop	406	RO
* Gasketing	S773BL	PE
1 Coordinator	2600	RO
1 Auto bolts	2842	RO
2 Sweep	209DV	PE
1 Threshold	2716A	PE

\* Full height of both jambs, full length of head.

**Set U-5 – Single / Access control / IT / rated / self closing** **612 UON**

3 Hinge	as required	MK
1 Elec lock	M1-82271-24V-BIPS-B-OE-LNL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO
* Gasketing	S773BL	PE
1 Power transfer	EL-CEPT	SU
2 wiring harness	QC-C – lengths as required	MK
1 Sweep	209DV	PE
1 Threshold	2716A	PE

\* Full height of both jambs, full length of head.

**Set U-5.1 – Double / Access control / IT / rated / self closing** **612 UON**

6 Hinge	as required	MK
1 Elec lock	M1-82271-24V-BIPS-B-OE-LNL	SA
2 Closer	351 UO	SA
2 Kick plate	K1050x6"	RO
2 Wall stop	406	RO
* Gasketing	S773BL	PE
1 Power transfer	EL-CEPT	SU
2 wiring harness	QC-C – lengths as required	MK
2 Sweep	209DV	PE
1 Threshold	2716A	PE
1 Coordinator	2600	RO
1 Auto bolts	2842	RO

\* Full height of both jambs, full length of head.

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<b>Set U-6 – Single / HV Electrical / fire rated</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Exit Device	12 8804 ETL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO
* Gasketing	S773BL	PE
1 Sweep	209DV	PE
1 Threshold	2716A	PE

\* Full height of both jambs, full length of head.

<b>Set U-7 – Double / HV Electrical / fire rated</b>		<b>612 UON</b>
6 Hinge	as required	MK
2 Exit Device	12 8706 ETL	SA
2 Closer	351 UO	SA
2 Kick plate	K1050x6"	RO
2 Wall stop	406	RO
* Gasketing	S773BL	PE
2 Sweep	209DV	PE
1 Threshold	2716A	PE

\* Full height of both jambs, full length of head.

<b>Set U-8 – Single tunnel / attic access / rated / self closing</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Lockset	8204-LNL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Wall stop	406	RO
* Gasketing	S773BL	PE
1 Sweep	209DV	PE
1 Threshold	2716A	PE
1 Local alarm	EAX-500	DETEX
(With Mortise shell)		
1 Door contact	DPS	SE

\* Full height of both jambs, full length of head.

**Sequence** – Door normally closed and locked. Any use of door breaks contact and reports to security system. Local alarm separately key controlled. Include keying for local alarm on keying chart.

<b>Set U-9 – Single Fan Coil Unit / fire rated</b>		<b>612 UON</b>
3 Hinge	418	SOS
1 Lockset	S2002C	SA
* Gasketing	S773BL	PE
1 Sweep	209DV	PE
1 Threshold	2716A	PE

\* Full height of both jambs, full length of head.

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<b>Set X-1 – Single / Ext ADA access control / non rated</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Exit Device	LD-55-56-8804-ETL	SA
1 Auto operator	4640 REG	LC
2 Actuator	CM45xWT	Camden Door controls
1 Kick plate	K1050x6"	RO
1 Threshold	253x3xFG MSES25SS	PE
1 Sweep	3452DNB TKSP8	PE
1 Overhead stop	1-X36	RF
* Gasketing	S773BL	PE
1 Power transfer	EL-CEPT	SU
2 wiring harness	QC-C – lengths as required	MK
1 Door contact	DPS-M	SU
1 Prox reader	By Owner	
1 Power supply	By Electrical	
1 Bollard	8310	LC

\* Full height of both jambs, full length of head.

**Sequence:** Door closed & locked at all times. Presenting valid credential outside shunts door position switches, activates ELR, activates exterior actuator, & allows for authorized entrance. Inside free at all time for immediate egress. Operating inside trim activates request to exit switch in lock shunting door position switch and allowing authorized egress. Operating inside actuator shunts door position switch, activates ELR, and allows authorized egress. With loss of power or activation of building fire system door remains locked.

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<b>Set X-2 – Single / Exterior access control / non rated</b>		<b>612 UON</b>
3 Hinge	as required	MK
1 Exit Device	LD-55-56-8804-ETL	SA
1 Closer	351 UO	SA
1 Kick plate	K1050x6"	RO
1 Threshold	253x3xFG MSES25SS	PE
1 Sweep	3452DNB TKSP8	PE
1 Overhead stop	1-X36	RF
* Gasketing	S773BL	PE
1 Power transfer	EL-CEPT	SU
2 wiring harness	QC-C – lengths as required	MK
1 Door contact	DPS-M	SU
1 Prox reader	By Owner	
1 Power supply	By Electrical	

\* Full height of both jambs, full length of head.

**Sequence:** Door closed & locked at all times. Presenting valid credential outside shunts door position switches, retracts latches & allows for authorized entrance. Inside free at all time for immediate egress. Operating inside trim activates request to exit switch in lock shunting door position switch and allowing authorized egress. With loss of power or activation of building fire system door remains locked.

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<b>Set X-3 – Double / Access control / self closing</b>		<b>612 UON</b>
6 Hinge	as required	MK
1 Elec lock	RX-8271-24V-LNL	SA
2 Closer	351 UO	SA
2 Kick plate	K1050x6"	RO
2 Wall stop	406	RO
* Gasketing	S773BL	PE
1 Power transfer	EL-CEPT	SU
2 wiring harness	QC-C – lengths as required	MK
2 Sweep	209DV	PE
1 Threshold	2716A	PE
1 Coordinator	2600	RO
1 Auto bolts	2842	RO
2 Door position switch	DPS	SU
1 Prox Reader	By Owner	
1 Split Astragal	303AV	PE

\* Full height of both jambs, full length of head.

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<b>Set X-4 – Double / self closing</b>		<b>612 UON</b>
6 Hinge	as required	MK
1 Lockset	8204 LNL	SA
2 Closer	351 UO	SA
2 Kick plate	K1050x6"	RO
2 OH stop	1-X36	RF
* Gasketing	S773BL	PE
2 Sweep	209DV	PE
1 Threshold	2716A	PE
1 Coordinator	2600	RO
1 Auto bolts	2842	RO
2 Door contact	DPS	SU
1 Split Astragal	303DV	PE

\* Full height of both jambs, full length of head.

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<b>Set X-5 – Double / self closing</b>		<b>612 UON</b>
1 Auto Operator	4640 REG	LC
2 Actuator	CM45xWT	Camden Door Controls
Balance of hardware is existing to remain.		

Provide wiring and pathways to existing card reader, ELR exit device, and DPS.

**Sequence:** shall be same as X-1

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<b>Set X-6 – Roof maintenance access</b>		<b>612 UON</b>
1 Cylinder	as required	SA
Balance of hardware by window manufacturer.		

Provide cylinder to match owner keying system.

<u>Set X-7 – Modified existing exterior</u>		<u>626 UON</u>
1 Actuator	CM45xWT	Camden Door controls
1 Prox reader	By owner	
1 Bollard	42-BSU-IG	Camden Door Controls

Balance of hardware is existing to remain.

Provide wiring and pathways, install bollard at exterior and coordinate operation with balance of hardware.

**Sequence** shall be same as Set X-1

<u>Set X-8 – Modified existing exterior</u>		<u>612 UON</u>
1 Prox reader	By owner	
1 Exit Device	LD-55-56-8804-ETL	SA
2 wiring harness	QC-C – Length as required	MK
1 Door contact	DPS-M	SU
1 Power transfer	EL-CEPT	SU

Balance of hardware is existing to remain

**Sequence** shall be same as Set X-2

END OF SECTION 087100

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Section 08 81 23  
EXTERIOR GLASS GLAZING

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. General requirements and definition of glass types for glazing work specified under other individual specifications.
  - 1. Insulated glass in aluminum windows.
  - 2. Insulated glass in exterior doors.
- B. Furnish and install the following:
  - 1. All materials required to properly install glass furnished hereunder, including sealant, tapes, setting blocks, and spacers.
- C. Work of this section includes installation of glazing beads furnished under related sections.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 10 00 - ROUGH CARPENTRY: Installation of steel door frames.
- D. Section 06 20 00 - FINISH CARPENTRY: Installation of doors.
- E. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.
- F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Steel doors, door and window frames, and related glazing stops, for both fire-resistance rated (labeled) and non-rated (labeled) conditions.
- G. Section 08 14 33 - STILE AND RAIL WOOD DOORS.
- H. Section 08 14 34 - CUSTOM FABRICATED STILE AND RAIL WOOD DOORS.
- I. Section 08 51 13 – ALUMINUM WINDOWS.

- J. Section 08 14 34 – CUSTOM FABRICATED STILE AND RAIL WOOD DOORS AND FRAMES.
- K. Section 08 81 23 - EXTERIOR GLASS GLAZING.
- L. Section 10 28 13 - TOILET ACCESSORIES: Framed mirrors.

#### 1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. AAMA 804.1 - Ductile Back-Bedding Compound.
  - 2. ASTM C 1036 - Flat Glass.
  - 3. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
  - 4. ASTM E 546 - Test Method For Frost Point of Sealed Insulating Glass Units.
  - 5. ASTM E 576 - Test Method for Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
  - 6. ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
  - 7. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
  - 8. Federal Safety Standards for Architectural Glazing Materials 16CFR1201.
  - 9. FS TT-S-001543A - Sealing Compound, Silicone Rubber Base.
  - 10. IGCC: Certified Products Directory, and Certification Guidelines.
  - 11. NFPA Publication 80 - Fire Doors and Windows.
  - 12. SGCC: Certified Products Directory, and Certification Guidelines.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
  - 1. GANA Laminated Glazing Reference Manual (2009 edition).
  - 2. GANA - Glazing Manual (50<sup>th</sup> Anniversary edition).
  - 3. SIGMA - Vertical Glazing Guidelines, Number A3000-87.
  - 4. Consumer Product Safety Commission (CPSC) 16CFR 1201 Code of Federal Regulations for Architectural Glazing Materials.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing:
  - 1. Field Measurements

- a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
- b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  1. Product Data:
    - a. Product data sheets on glazing products: Provide chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.
    - b. Sample Warranty: Provide copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
  2. Shop Drawings: Show sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
    - a. Plans and elevations 1/4 inch scale of each type of glazing assembly, and mirror assembly; indicate dimensions, and reference details. Verify dimensions with field measurements.
  3. Verification Samples:
    - a. 12 x 12 inch pieces of each specified type and thickness of glass, bearing labels indicating locations where each type of glass will be used.
    - b. Glazing tape: 12 inch length of specified type and size.
  4. Certificates: Manufacturer's written certification stating that the materials installed, meet or exceed the requirements specified under this Section.
  5. Source Quality Control Submittals:
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
  1. Bonds and Warranty Documentation:
    - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

## 1.7 QUALITY ASSURANCE

- A. General: Perform glazing work in accordance with GANA Glazing Manual, SIGMA and LSGA standards for glazing and installations methods.
  1. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Glass Labeling:
  1. General: Manufacturer's Label shall be, acid-etched, sandblasted, ceramic-fired, laser-etched, embossed, or other similar type which, once applied, cannot be removed without being destroyed.



- a. Safety glass: Label tempered and laminated safety glass with permanent manufacturer's label on each light with the mark visible after installation. Furnish SGCC certification for safety glass in compliance with CPSC 16 CFR 1201 Cat 1 or Cat 11, or ANSI Z-97.1.
    2. Fire-rated glass: Label each individual glazing unit with appropriate UL, Warnock Hersey, or other approval labeled markings with the listing mark visible after installation.
  - C. Qualifications:
    1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:
    1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
    2. Deliver materials in labeled, protective packages, when and as required.
  - B. Storage and Handling Requirements:
    1. Store and handle in strict compliance with manufacturer's instructions and recommendations of GANA Glazing Manual. Use clean gloves and tools when handling materials, avoid contamination. Use rolling blocks and suction cups to move glass units not in shipping crates.
      - a. Carefully store materials to avoid overloading any building component or structure.
      - b. Do not unpack material until it is to be set, unless un-packing is required for inspection by the Architect.
    2. Protect factory finished materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- 1.9 SITE CONDITIONS
- A. Do not install glazing when ambient temperature is less than 50 degrees Fahrenheit.
  - B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
- 1.10 WARRANTY
- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
  - B. Manufacturer Warranty/Guarantee: All shall include replacement of defective glass and mirrors, and delivery of replacement glass products furnished f.o.b. from point of manufacturer to project site.
    1. Insulating Glass: Manufacturer's 10 year written guarantee covering insulating glass against defects in materials and workmanship, including failure of seals effective on date of original factory shipment to site.

- a. Provide coverage in Guarantee for manufacturing defects, including failure of hermetic seal of air space (except by glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating or other visual indications of seal failure or performance.
2. Laminated glass: Manufacturer's 4 year written guarantee covering against defects in materials and workmanship of laminated glass and replacement of the same. Warranty shall be effective from date of original factory shipment to site.
  - a. Provide coverage in Guarantee for manufacturing defects, including failure of laminated glass units as evidenced by edge separation, delamination, or discoloration of inner layer.

## **PART 2 - PRODUCTS**

### **2.1 GLASS - GENERAL**

- A. General requirements for glass: Of domestic and foreign manufacture, conforming to the referenced standards and with the additional requirements specified herein; factory labeled on each pane stating the strength, type, thickness and quality; with all labels remaining on glass until final cleaning.
  1. Glass thickness shown and heat treatment specified are minimum requirements. Provide glass thickness and heat treatment as required to meet specified performance criteria, State and local codes and ordinances.
- B. Insulated Glass Units: Conform to Class CBA of Insulating Glass Certification Council (IGCC), with a hermetically sealed dehydrated sealed air space, and tested in accordance with ASTM E 2190.
- C. Float Glass: Comply with ASTM C 1036, Class 1 clear, quality q3 glazing select.
- D. Heat Strengthened Glass: Comply with ASTM C 1048 HS, heat strengthened, Class 1 clear, quality q3 glazing select.
- E. Tempered Glass: Comply with ASTM C 1048 FT, fully tempered, Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1.
- F. Laminated glass: consisting of an outer face and inner face of specified glass, factory laminated to polyvinyl butyl (PVB) interlayer equal to Monsanto "Saflex" or DuPont "Butacite", or DuPont high strength interlayer "SentryGlassPlus". Certified by Safety Glazing Certification Council. Glass shall be free from foreign substances and air pockets.

### **2.2 REQUIREMENTS FOR SAFETY GLASS**

- A. Safety Glass (fully tempered glass or laminated) glass is required at conditions identified by applicable codes, which include, but are not limited to the following:
  1. Glazing in swinging doors except jalousies.
  2. Glazing in fixed and sliding panels of sliding patio door assemblies and panels in other doors, including walk-in closets and wardrobes.
  3. Glazing in storm doors.
  4. Glazing in unframed swinging doors.

5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers.
6. Glazing in any portion of a building wall enclosing these above compartments where the exposed edge of the glazing is less than 60 inches above a standing surface.
7. Glazing in a individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches above a walking surface. (panels where there is an intervening wall or other permanent barrier between the door and the glazing are exempt.)
8. Glazing in an individual fixed or operable panel where the exposed area of an individual pane is greater than 9 square feet and the exposed bottom edge is less than 18 inches above the floor, the exposed top edge is greater than 36 inches above the floor, and one or more walking surface(s) are within 36 inches horizontally of the plane of the glazing. Exceptions include a panel with a protective bar (1-1/2 inches or more in height and capable of withstanding a horizontal load of 50 pounds per linear foot without contacting the glass installed on the accessible sides of the glazing 34 inches to 38 inches above the floor), and an outboard pane in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 25 feet or more above any grade, roof, walking surface of other horizontal or sloped surface adjacent to the glass interior.
9. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of height above a walking surface.
10. Glazing in walls and fences enclosing indoor and outdoor swimming pools and spas when the bottom edge of the glazing on the pool side is less than 60 inches above a walking surface on the pool side of the glazing and the glazing is within 60 inches horizontally of a water's edge.
11. Glazing adjacent to stairways, landings and ramps when it is within 36 inches horizontally of a walking surface, within 60 inches horizontally of a bottom tread of a stairway in any direction, and the bottom edge is less than 60 inches above the plane of the adjacent walking surface (or stairway, measured from the nose of the tread).

## 2.3 GLASS – TYPES

- A. Glass Type GL-1: Insulated double “Low-E,” glass 1 inch thick units with internal simulated divided lights coordinated and aligned with window muntins:
  1. Basis of Design: Vitro Architectural Glass, Pittsburgh PA (formerly PPG) “Solarban 70XL (2)”.
  2. Components
    - a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened clear glass, with Low-E sputter coating on number 2 surface.
      - 1) Provide aluminum muntins on number 1 surface (surface applied to glass, or mechanically fastened to window sash), 1/2 inch flat stock, and internal floating grid between number 2 and 3 surfaces.
    - b. Inner layer: 1/4 inch (6 mm) thick clear heat-strengthened glass.
    - c. Air space: 1/2 inch (13 mm) thick.

- 1) Gas fill: 90% Argon/10% Air.
- B. Glass Type GL-2 - Insulated Glass with frosted appearance: 1 inch thickness, with internal simulated divided lights coordinated and aligned with window muntins:
1. Basis of Design: Same as Glass Type 1, as modified herein below.
    - a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened clear glass, with Low-E sputter coating on number 2 surface.
      - 1) Provide aluminum muntins on number 1 surface (surface applied or mechanically fastened), 1/2 inch flat stock, and internal floating grid between number 2 and 3 surfaces.
    - b. Inner layer: 1/4 inch (6 mm) thick clear heat-strengthened glass with laminated "obscure" frosted laminated on number 3 surface.
      - 1) 'Frosted' Laminate: Equal to Eastman Chemical Company (Saflex Brand), St. Louis, MO., product "Vanceva Artic Snow."
    - c. Air space: 1/2 inch (13 mm) thick.
      - 1) Gas fill: 90% Argon/10% Air.
- C. Glass Type GL-3 (areaways): Insulated double "Low-E," glass 1 inch thick units:
1. Basis of Design: Vitro Architectural Glass, Pittsburgh PA (formerly PPG) "Solarban 70XL (2)".
  2. Components
    - a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened clear glass, with Low-E sputter coating on number 2 surface.
    - b. Inner layer: 1/4 inch (6 mm) thick clear heat-strengthened glass.
    - c. Air space: 1/2 inch (13 mm) thick.
      - 1) Gas fill: 90% Argon/10% Air.
- D. Glass Type GL-4: Insulated double "Low-E," glass 1 inch thick units:
1. Basis of Design: Vitro Architectural Glass, Pittsburgh PA (formerly PPG) "Solarban 70XL (2)".
  2. Components
    - a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened clear glass, with pyrolytic Low-E sputter coating on number 2 surface.
      - 1) Provide with exterior self adhesive Lead Caming Tape, came thickness to match existing caming on number 1 and 2 surfaces.
    - b. Inner layer: 1/4 inch (6 mm) thick clear heat-strengthened glass.
    - c. Air space: 1/2 inch (13 mm) thick.
      - 1) Gas fill: 90% Argon/10% Air.
- E. Glass Type GL-5 - Insulated Glass with frosted appearance: 1 inch thickness, consisting of:
1. Basis of Design: Same as Glass Type 1, as modified herein below.
    - a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened clear glass, with Low-E sputter coating on number 2 surface.
      - 1) Provide with exterior self adhesive Lead Caming Tape, came thickness to match existing caming on number 1 and 2 surfaces.

- b. Inner layer: 1/4 inch (6 mm) thick clear heat-strengthened glass with laminated "obscure" frosted laminated on number 3 surface.\
    - 1) 'Frosted' Laminate: Equal to Eastman Chemical Company (Saflex Brand), St. Louis, MO., product "Vanceva Artic Snow."
  - c. Air space: 1/2 inch (13 mm) thick.
    - 1) Gas fill: 90% Argon/10% Air.
- F. Glass Type GL-6 - Insulated Fire-rated Glass: 1-5/16 inch thickness, consisting of:
- 1. Basis of Design: Same as Glass Type 1, as modified herein below.
    - a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened clear glass, with Low-E sputter coating on number 2 surface.
      - 1) Provide aluminum muntins on number 1 surface (surfaced applied or mechanically fastened), 1/2 inch flat stock, and internal floating grid between number 2 and 3 surfaces.
      - 2) Inner layer: "Fire Protective Glass": 45 minute rated 3/4 inch transparent wire-less fire rated laminated ceramic glazing material with polished finish.
        - a) Basis of Design: Pilkington Pyrostop 25-260.
        - b) Conform with latest edition of ASTM E152, ASTM E163, NFPA-80, NFPA 252, NFPA 257, and glass to be labeled "O" or "W".
        - c) Conform with latest edition of NFPA 257 for Hose Stream Testing, and glass shall be labeled "H" designation.
        - d) Conforms to ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
        - e) In accordance with manufacturer's specifications, Firelite Plus must be glazed into frames with a similar rating, using silicone glazing compound which shall be supplied with the Firelite Plus material.  
Permanently identify each individual glazing unit with a listing mark visible after installation.
    - b. Air space: 1/4 inch (13 mm) thick.
      - 1) Gas fill: 90% Argon/10% Air.
- G. Glass Type GL-7: Insulated double "Low-E," glass 1 inch thick units:
- 1. Basis of Design: Vitro Architectural Glass, Pittsburgh PA (formerly PPG) "Solarban 70XL (2)".
  - 2. Components
    - a. Outer layer: 1/4 inch (6 mm) thick tempered clear glass, with Low-E sputter coating on number 2 surface.
      - 1) Provide aluminum muntins on number 1 surface (surface applied or mechanically fastened), 1/2 inch flat stock, and floating grid 1/2 inch flat stock.
    - b. Inner layer: 1/4 inch (6 mm) thick clear tempered glass.
    - c. Air space: 1/2 inch (13 mm) thick.
      - 1) Gas fill: 90% Argon/10% Air.

- H. Glass Type GL-8: IGU/Clear (Shafts): Provide siumated divided lites to match existin grid pattern, color and profile; install muntins at surface 1, and floating grid in-between surfaces numbers 2 and 3.
  - 1. No Low-E coatings for GL-8.

#### 2.4 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Fabricate glass as required to openings with edge clearances and bite on glass as recommended by the manufacturer with clean-cut edges where concealed, and smooth-ground, polished and seamed edges where exposed to view. Do not cut, seam, nip or abrade glass after heat-tempering.
  - 1. For non-tempered to be cut at site, provide glass larger than required so as to obtain clean cut edges without seaming or nipping.
- C. Fabricate glass with the following edge treatments.
  - 1. Exposed edges: Polished-finished radiused (penciled).
  - 2. Concealed edges: Cut edges with minimum edge work.
  - 3. Butt-joint edges: Flat round and finished with edges eased.
- D. Shop Fabrication:
  - 1. All vision panels and baffles shall be cut to size by manufacturer or by fabricator prior to delivery to site. All glass edges shall be ground smooth, polished and eased. Provide all necessary holes wherever required by the approved Shop Drawings, drilled and tapped to suite project requirements. Do all cutting and drilling prior to tempering.

#### 2.5 ACCESSORIES

- A. Glazing tape: Preformed butyl-polyisobutylene rubber with 100 percent solids contained in extruded tape roll form and complying with AAMA 804.1; coiled on release paper; of sizes required for proper glazing. equal to one of the following:
  - 1. Protective treatments 3030 or 606.
  - 2. Tremco Preshimmed 440.
  - 3. Woodmont Chem-Tape 40.
- B. Setting blocks: Neoprene, 80-90 shore A durometer hardness, certified to be "silicone compatible"; sized as follows:
  - 1. Length: 0.1 inch per square foot of glass, but not less than 4 inches.
  - 2. Width: equal to glazing rabbet space minus 1/16 inch.
  - 3. Height to suit glazing method and pane weight and area.
- C. Spacers: Neoprene, 60-80 shore A durometer hardness; sized as required.
- D. Glazing sealant:
  - 1. Joint Sealer Type SG (Silicone, general-purpose on-site glazing and repair glazing sealant): One-part medium modulus, neutral curing, synthetic rubber sealant, having a useful life expectancy of at least 20 years, conforming to

ASTM C 920, Type S, grade NS, Class 50 for uses NT, G and A. Color as selected by Architect:

- a. Dow Corning, product "795".
  - b. GE Silicones, product "SilGlaze II SCS2800".
  - c. Tremco, product, "Spectrim 2".
- E. Bond-breakers and backing materials: Type recommended by manufacturer of sealants and gaskets.
- F. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION AND PREPARATION**

- A. Inspect receiving surfaces and ensure that they are dry and free from dust, or other foreign materials before glazing. Clean all surfaces with cloth saturated with mineral spirits of high-flash naphtha as recommended by glazing tape manufacturer, before glazing.
- B. Field Measurements: Verify that field measurements are as indicated on approved Shop Drawings.
1. Check all openings, prior to glazing, to make certain that the opening is square, plumb and secure in order that uniform face and edge clearances are maintained.
  2. Determine the actual sizes required by measuring the receiving openings. Size glass and mirrors to permit required clearance and bite around full perimeter of glass, as set forth in the referenced FGMA standards, or as recommended by the glass manufacturer. Do not nip edges, to remove flares or to reduce oversize dimensions, under any circumstance.
- C. Beginning of installation means acceptance of existing conditions.

#### **3.2 GENERAL INSTALLATION OF GLASS HAVING PERMANENT LABELS**

- A. Install glass units so that appropriate manufacturer's permanent label for safety glass, and permanent label for fire-rated glass are visible.

#### **3.3 INSTALLATION - WET GLAZING**

- A. Utilize wet glazing methods for field installation of glass in exterior curtainwall, storefront, window systems at exterior custom stile and rail wood doors.
- B. Place setting blocks at quarter points on web of sill receiving member. Set glass unit in place with equal spaces on all sides.
- C. Install spacers at a spacing not exceeding 24 inches apart uniformly around perimeter, between interior face of glass unit and the fixed glazing rabbet.
- D. Apply a continuous heel bead of specified sealant between the outer edges of the glass unit and the web of the receiving member, in sufficient quantity to engage the leg of the applied glazing stop, when installed.

- E. As the glazing stop is being applied, install spacers between the outer face of the glass unit and the stop, locating the spacers directly opposite the previously installed interior spacers. Install the glazing stops, ensuring that all clearances around the perimeter of the glass unit conform to the requirements of the respective standards referenced herein.
- F. Apply a continuous bead of sealant around the exterior and interior perimeters, between the glass unit and the fixed rabbet, and between the glass unit and the applied glazing stop, extending the sealant material slightly above the sight line to permit proper tooling thereof.
- G. Tool all exposed sealant at a 45 degree angle away from the glass surface, leaving the sealant surface uniformly dense and smooth.
- H. Immediately remove all excess sealant from surfaces of metal and glass.

#### 3.4 PROTECTION

- A. Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Do not apply warning markings directly to the glass.
- B. Cover glass To protect it from activities that might abrade the glass surface.

#### 3.5 CLEANING

- A. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess glazing tape, labels, dirt, and other contaminants.

#### 3.6 SAFETY GLASS SCHEDULE

- A. Safety Glass (fully tempered glass or laminated) glass is required at conditions identified by applicable codes, which include, but are not limited to the following:
  - 1. Glazing in swinging doors except jalousies.
  - 2. Glazing in fixed and sliding panels of sliding patio door assemblies and panels in other doors, including walk-in closets and wardrobes.
  - 3. Glazing in storm doors.
  - 4. Glazing in unframed swinging doors.
  - 5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers.
  - 6. Glazing in any portion of a building wall enclosing these above compartments where the exposed edge of the glazing is less than 60 inches above a standing surface.
  - 7. Glazing in a individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches above a walking surface. (panels where there is an intervening wall or other permanent barrier between the door and the glazing are exempt.)
  - 8. Glazing in an individual fixed or operable panel where the exposed area of an individual pane is greater than 9 square feet and the exposed bottom edge is



less than 18 inches above the floor, the exposed top edge is greater than 36 inches above the floor, and one or more walking surface(s) are within 36 inches horizontally of the plane of the glazing. Exceptions include a panel with a protective bar (1-1/2 inches or more in height and capable of withstanding a horizontal load of 50 pounds per linear foot without contacting the glass installed on the accessible sides of the glazing 34 inches to 38 inches above the floor), and an outboard pane in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 25 feet or more above any grade, roof, walking surface of other horizontal or sloped surface adjacent to the glass interior.

9. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of height above a walking surface.
10. Glazing in walls and fences enclosing indoor and outdoor swimming pools and spas when the bottom edge of the glazing on the pool side is less than 60 inches above a walking surface on the pool side of the glazing and the glazing is within 60 inches horizontally of a water's edge.
11. Glazing adjacent to stairways, landings and ramps when it is within 36 inches horizontally of a walking surface, within 60 inches horizontally of a bottom tread of a stairway in any direction, and the bottom edge is less than 60 inches above the plane of the adjacent walking surface (or stairway, measured from the nose of the tread).

End of Section

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Section 08 81 26  
INTERIOR GLASS GLAZING

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. General requirements and definition of glass types for glazing work specified under other individual specifications.
- B. Furnish and install the following:
  - 1. Tempered glass in wood and hollow metal doors and frames.
  - 2. Low-iron glass at locations indicated and scheduled.
  - 3. Frosted translucent laminated glass.
  - 4. Wire-less fire resistant rated glazing in designated rated doors and frames.
  - 5. Frameless mirrors.
  - 6. All materials required to properly install glass furnished hereunder, including sealant, tapes, setting blocks, and spacers.
- C. Work of this section includes installation of glazing beads furnished under related sections.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 10 00 - ROUGH CARPENTRY: Installation of steel door frames.
- D. Section 06 20 00 - FINISH CARPENTRY: Installation of doors.
- E. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.
- F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Steel doors, door and window frames, and related glazing stops, for both fire-resistance rated (labeled) and non-rated (labeled) conditions.
- G. Section 08 14 16 - FLUSH WOOD DOORS: Wood doors, and related glazing stops.

- H. Section 08 14 33 - STILE AND RAIL WOOD DOORS.
- I. Section 08 14 34 - CUSTOM FABRICATED STILE AND RAIL WOOD DOORS.
- J. Section 08 81 23 - EXTERIOR GLASS GLAZING.
- K. Section 08 87 00 – GLAZING SURFACE FILMS.
- L. Section 10 28 13 - TOILET ACCESSORIES: Framed mirrors.

#### 1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - References. . Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. AAMA 804.1 - Ductile Back-Bedding Compound.
  - 2. ASTM C 1036 - Flat Glass.
  - 3. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
  - 4. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
  - 5. Federal Safety Standards for Architectural Glazing Materials 16CFR1201.
  - 6. FS TT-S-001543A - Sealing Compound, Silicone Rubber Base.
  - 7. NFPA Publication 80 - Fire Doors and Windows.
  - 8. SGCC: Certified Products Directory, and Certification Guidelines.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
  - 1. GANA - Glazing Manual (50<sup>th</sup> Anniversary edition).
  - 2. Consumer Product Safety Commission (CPSC) 16CFR 1201 Code of Federal Regulations for Architectural Glazing Materials.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
  - 2. Glazing installed in wood frames: Closely coordinate work of this Section 08 80 00 with woodworking trades specified under Division 6. Assure that wood frames are installed plumb and true, and are securely anchored. Verify wood frames are properly routed with glazing rabbits clear from any obstruction, and equipped with wood stops to permit proper installation.
- B. Sequencing:
  - 1. Field Measurements

- a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
- b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  1. Product Data:
    - a. Product data sheets on glazing products: Provide chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.
    - b. Sample Warranty: Provide copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
  2. Shop Drawings: Show sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
    - a. Plans and elevations 1/4 inch scale of each type of glazing assembly, and mirror assembly; indicate dimensions, and reference details. Verify dimensions with field measurements.
    - b. Large scale design details of glazing conditions; indicating sizes, types, and gauges of all metal components; glazing details, indicating types and thickness of glass; bracing and stabilizing members; attachment clips and brackets; and complete installation details.
  3. Verification Samples:
    - a. 12 x 12 inch pieces of each specified type and thickness of glass, bearing labels indicating locations where each type of glass will be used.
    - b. Glazing tape: 12 inch length of specified type and size.
  4. Certificates: Manufacturer's written certification stating that the materials installed, meet or exceed the requirements specified under this Section.
  5. Source Quality Control Submittals:
  6. LEED Submittal Requirements:
    - a. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
      - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
        - a) The exposure scenario used to determine compliance.
        - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
        - c) Laboratory accreditation under ISO/IEC 17025.

- d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Bonds and Warranty Documentation:
    - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

## 1.7 QUALITY ASSURANCE

- A. General: Perform glazing work in accordance with GANA Glazing Manual, for glazing and installations methods.
1. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Glass Labeling:
1. General: Manufacturer's Label shall be, acid-etched, sandblasted, ceramic-fired, laser-etched, embossed, or other similar type which, once applied, cannot be removed without being destroyed.
  2. Safety glass: Label tempered safety glass with permanent manufacturer's label on each light with the mark visible after installation.
    - a. Furnish SGCC certification for safety glass in compliance with CPSC 16 CFR 1201 Cat 1 or Cat 11, or ANSI Z-97.1.
  3. Fire-rated glass: Label each individual glazing unit with appropriate UL, Warnock Hersey, or other approval labeled markings with the listing mark visible after installation.
- C. Qualifications:
1. Fabricators: Glazier specializing in applying the work of this Section with a minimum of 5 years experience.
  2. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

## 1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  2. Deliver materials in labeled, protective packages, when and as required.
- B. Storage and Handling Requirements:
1. Store and handle in strict compliance with manufacturer's instructions and recommendations of GANA Glazing Manual. Use clean gloves and tools when

handling materials, avoid contamination. Use rolling blocks and suction cups to move glass units not in shipping crates.

- a. Carefully store materials to avoid overloading any building component or structure.
  - b. Do not unpack material until it is to be set, unless un-packing is required for inspection by the Architect.
2. Store mirrors and coated glass in a dry place with acid-free paper between glass sheets.
  3. Protect factory finished materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

#### 1.9 SITE CONDITIONS

- A. Do not install glazing when ambient temperature is less than 50 degrees Fahrenheit.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

#### 1.10 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manufacturer Warranty/Guarantee: All shall include replacement of defective glass and mirrors, and delivery of replacement glass products furnished f.o.b. from point of manufacturer to project site.
  1. Mirrors: Manufacturer's 5 year written guarantee covering against defects in materials and workmanship of reflective coatings on mirrors and replacement of the same.
    - a. Provide coverage in Guarantee for manufacturing defects, including failure of reflective coatings as evidenced by peeling, cracking, discoloration, deterioration in metallic coating, or other visual indications of failure.

### PART 2 - PRODUCTS

#### 2.1 GLASS - GENERAL

- A. General requirements for glass: Of domestic and foreign manufacture, conforming to the referenced standards and with the additional requirements specified herein; factory labeled on each pane stating the strength, type, thickness and quality; with all labels remaining on glass until final cleaning.
  1. Glass thickness shown and heat treatment specified are minimum requirements. Provide glass thickness and heat treatment as required to meet specified performance criteria, State and local codes and ordinances.
- B. Heat Strengthened Glass: Comply with ASTM C 1048 HS, heat strengthened, Class 1 clear, quality q3 glazing select.

- C. Tempered Glass: Comply with ASTM C 1048 FT, fully tempered, Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1.
- D. Mirror glass: ASTM C 1036, type 1 transparent, flat Class 1 clear, quality q1 mirror select glass, and ASTM C 1503 electro-copper back-plated laminated to a concealed from view corrosion-resistant zinc-coated back, with all edges of the glass ground and polished.

## 2.2 GLASS – TYPES

- A. Glass Type GL-11 - Tempered Safety Glass, clear: 1/4 inch thick.
- B. Glass Type GL-12: 5/16 inch transparent wire-less fire protective ceramic glazing material with polished finish: Technical Glass Products., "Firelite Plus".
  - 1. For fire rated door assemblies, conform with latest edition of ASTM E152, ASTM E163, NFPA-80, NFPA 252, NFPA 257.
  - 2. Conforms to ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
  - 3. Permanently identify each individual glazing unit with a listing mark visible after installation.
  - 4. In accordance with manufacturer's specifications, Firelite Plus must be glazed into frames with a similar rating, using silicone glazing compound which shall be supplied with the Firelite Plus material.
- C. Glass Type GL-13 - Frameless mirror glass, 1/4 inch thick:
  - 1. Size: Provide sizes shown. If not shown, provide continuous one piece mirrors from top of back splash to the underside of ceiling and extending in one piece the full length of the countertop. Extend mirrors wall to wall where countertop is in an alcove.
- D. Glass Type GL-14 - Frosted Translucent Laminated Glass: Nominal 1/4 inch (6.4 mm) thick specialty glass consisting of an outboard face and an inner (inboard) face of 1/8 inch (3 mm) thick q5 float glass laminated to a 0.015 inch (0.38 mm) thick white pigmented inter-layer. Grind smooth all edges not set into glazing beads.
  - 1. Basis of Design Pattern: Basis of Design: Eastman Chemical Company (Saflex Brand), St. Louis, MO., product "Vanceva Artic Snow."
    - a. Solar transmittance: 0.60 percent.
    - b. Visible light transmittance: 0.68 percent.
    - c. Shading coefficient: 0.78.
    - d. Solar Heat Gain Coefficient (SHGC): 0.68.

## 2.3 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Fabricate glass as required to openings with edge clearances and bite on glass as recommended by the manufacturer with clean-cut edges where concealed, and smooth-ground, polished and seamed edges where exposed to view. Do not cut, seam, nip or abrade glass after heat-tempering.

1. For non-tempered to be cut at site, provide glass larger than required so as to obtain clean cut edges without seaming or nipping.
- C. Fabricate glass with the following edge treatments.
1. Exposed edges: Polished-finished radiused (penciled).
  2. Concealed edges: Cut edges with minimum edge work.
  3. Butt-joint edges: Flat round and finished with edges eased.
- D. Shop Fabrication:
1. All vision panels and baffles shall be cut to size by manufacturer or by fabricator prior to delivery to site. All glass edges shall be ground smooth, polished and eased. Provide all necessary holes wherever required by the approved Shop Drawings, drilled and tapped to suite project requirements. Do all cutting and drilling prior to tempering.
  2. Mirrors: All mirrors shall be cut to size by fabricator prior to delivery to site. Carefully coordinate and provide notches and holes for mirror installations which are indicated to receive ballet barres, handrails and other products specified in individual Specification Sections, which protrude through mirror installation.

## 2.4 ACCESSORIES

- A. Glazing tape: Preformed butyl-polyisobutylene rubber with 100 percent solids contained in extruded tape roll form and complying with AAMA 804.1; coiled on release paper; of sizes required for proper glazing. equal to one of the following:
1. Protective treatments 3030 or 606.
  2. Tremco Preshimmed 440.
  3. Woodmont Chem-Tape 40.
- B. Setting blocks: Neoprene, 80-90 shore A durometer hardness, certified to be "silicone compatible"; sized as follows:
1. Length: 0.1 inch per square foot of glass, but not less than 4 inches.
  2. Width: equal to glazing rabbet space minus 1/16 inch.
  3. Height to suit glazing method and pane weight and area.
- C. Spacers: Neoprene, 60-80 shore A durometer hardness; sized as required.
- D. Mirror mastic for glass mirrors: Asphalt-based adhesive mirror mastic compatible with mirror backing for adhesive application to wall substrate. Provided mastic wall-board sealer as recommended by adhesive manufacturer.
1. Palmer Products Corporation, Louisville, KY., product: "Palmer Mirror Mastic".
  2. Pecora Corporation, Harleysville PA, product "7hr4 Mirror-Tac".
  3. Royal Adhesives and Sealants, South Bend, IL, "Gunther Brand" product "Ultra/Bond Mirror Mastic"
- E. Mirror mounting clips: Chrome plated brass, nickel plated brass, 'Anachrome' brass, or stainless steel J-shape mirror clips designed for 1/4 inch mirrors, minimum 1 inch support width, equal to C.R. Laurence Co., Inc., Los Angeles CA., "Dallas Mirror Clip", model N<sup>o</sup>. 778B.



- F. Glazing sealant:
  - 1. General glazing sealant: One-part medium modulus, neutral curing, synthetic rubber sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, grade NS, Class 25 for uses NT, G and A, FS TT-S-001543A, Type, Class A. Color as selected by Architect.
    - a. Dow Corning Corporation, Midland MI.; product, "Silicone Glazing Sealant".
    - b. General Electric Company (GE Silicones) Waterford NY.; product, "SilGlaze II SCS2800".
    - c. Tremco, Beachwood OH.; product, "Proglaze.
- G. Bond-breakers and backing materials: Type recommended by manufacturer of sealants and gaskets.
- H. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

## 2.5 ACCESSORIES FOR WIRE-LESS FIRE-PROTECTIVE GLAZING

- A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2.5 percent.
- B. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:
  - 1. Dow Corning Corporation, Midland MI.; product, "795".
  - 2. General Electric Company (GE Silicones) Waterford NY.; product "Silglaze-II 2800"
  - 3. Tremco, Beachwood OH.; product, "Spectrem 2".
- C. Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.

## PART 3 - EXECUTION

### 3.1 EXAMINATION AND PREPARATION

- A. Inspect receiving surfaces and ensure that they are dry and free from dust, or other foreign materials before glazing. Clean all surfaces with cloth saturated with mineral spirits of high-flash naphtha as recommended by glazing tape manufacturer, before glazing.
- B. Field Measurements: Verify that field measurements are as indicated on approved Shop Drawings.
  - 1. Check all openings, prior to glazing, to make certain that the opening is square, plumb and secure in order that uniform face and edge clearances are maintained.
  - 2. Determine the actual sizes required by measuring the receiving openings. Size glass and mirrors to permit required clearance and bite around full perimeter of glass, as set forth in the referenced FGMA standards, or as

recommended by the glass manufacturer. Do not nip edges, to remove flares or to reduce oversize dimensions, under any circumstance.

- C. Beginning of installation means acceptance of existing conditions.

### 3.2 GENERAL INSTALLATION OF GLASS HAVING PERMANENT LABELS

- A. Install glass units so that appropriate manufacturer's permanent label for safety glass, and permanent label for fire-rated glass are visible.

### 3.3 INSTALLATION - DRY GLAZING

- A. Utilize dry glazing methods for field installation of glass in interior doors and frames.
  - 1. Install in vision panels in fire-rated doors and frames to requirements of NFPA 80.
- B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (2 mm) above sight line.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane.
- E. Place glazing tape on free perimeter of glazing in manner as described above.
- F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- G. Knife trim protruding tape.

### 3.4 INSTALLATION - MIRRORS

- A. Examination: Verify that substrates to receive mirrors are plumb, true and of solid construction capable of supporting mirrors.
- B. Secure clips at quarter points unless otherwise detailed on the Drawings.
- C. Apply mirror mastic in accordance with manufacturer's instructions. Do not cover more than 25 percent of mirror back.
- D. Carefully adjust mirrors for perfectly plumb installations and to assure that reflected vertical and horizontal images are parallel to axis of room, and that all mirrors in any gang reflect a true and consistent image across their entire collective face. Distortion of images within any mirror panel, shifting of images, and double joints shall be corrected.
- E. Apply mirror into the clips and to the substrate so that areas not covered with mastic will remain open for ventilation with 1/8 inch minimum clearance from substrate. Secure the top edge of mirror with clips.
- F. Provide temporary rigid support until mastic sets.

### 3.5 PROTECTION

- A. Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Do not apply warning markings directly to the glass.
- B. Cover glass To protect it from activities that might abrade the glass surface.

### 3.6 CLEANING

- A. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess glazing tape, labels, dirt, and other contaminants.

### 3.7 SAFETY GLASS SCHEDULE

- A. Safety Glass (fully tempered glass or laminated) glass is required at conditions identified by applicable codes, which include, but are not limited to the following:
  - 1. Glazing in swinging doors except jalousies.
  - 2. Glazing in fixed and sliding panels of sliding patio door assemblies and panels in other doors, including walk-in closets and wardrobes.
  - 3. Glazing in storm doors.
  - 4. Glazing in unframed swinging doors.
  - 5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers.
  - 6. Glazing in any portion of a building wall enclosing these above compartments where the exposed edge of the glazing is less than 60 inches above a standing surface.
  - 7. Glazing in a individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches above a walking surface. (panels where there is an intervening wall or other permanent barrier between the door and the glazing are exempt.)
  - 8. Glazing in an individual fixed or operable panel where the exposed area of an individual pane is greater than 9 square feet and the exposed bottom edge is less than 18 inches above the floor, the exposed top edge is greater than 36 inches above the floor, and one or more walking surface(s) are within 36 inches horizontally of the plane of the glazing. Exceptions include a panel with a protective bar (1-1/2 inches or more in height and capable of withstanding a horizontal load of 50 pounds per linear foot without contacting the glass installed on the accessible sides of the glazing 34 inches to 38 inches above the floor), and an outboard pane in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 25 feet or more above any grade, roof, walking surface of other horizontal or sloped surface adjacent to the glass interior.
  - 9. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of height above a walking surface.
  - 10. Glazing in walls and fences enclosing indoor and outdoor swimming pools and spas when the bottom edge of the glazing on the pool side is less than 60

inches above a walking surface on the pool side of the glazing and the glazing is within 60 inches horizontally of a water's edge.

11. Glazing adjacent to stairways, landings and ramps when it is within 36 inches horizontally of a walking surface, within 60 inches horizontally of a bottom tread of a stairway in any direction, and the bottom edge is less than 60 inches above the plane of the adjacent walking surface (or stairway, measured from the nose of the tread).

End of Section

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Section 08 87 00  
GLAZING SURFACE FILMS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Privacy glazing film.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required LEED Certification of Project.
- C. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- D. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- E. Section 08 81 23 - EXTERIOR GLASS GLAZING.
- F. Section 08 81 26 - INTERIOR GLASS GLAZING.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
  - 1. ASHRAE - American Society for Heating, Refrigeration, and Air Conditioning Engineers; Handbook of Fundamentals.
  - 2. ASTM E 84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.

3. ASTM E 308 - Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System.
4. ASTM E 903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.
5. ASTM G 26 - Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight.
6. All Applicable federal, state and municipal codes, laws, and regulations for exits.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

##### A. Sequencing:

1. Field Measurements
  - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
  - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

#### 1.6 SUBMITTALS

##### A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data:
  - a. Product data sheets on glazing products: Provide chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.
  - b. Sample Warranty: Provide copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
2. Shop Drawings: For custom patterns (as appropriate).
3. Selection Samples: Sets of color chips representing manufacturer's full range of available colors and patterns.
4. Verification Samples: Minimum 12 x 12 inch Samples representing actual product color and opacity.
5. Test and Evaluation Reports: Provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film manufacturer.
6. Manufacturer's Instructions:
  - a. Preparation instructions and recommendations.
  - b. Installation methods.

##### B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Bonds and Warranty Documentation:
  - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Qualifications:
  - 1. Installer/Applicator: Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.

1.8 FIELD-SAMPLE / MOCK-UP

- A. Provide field sample / mock-up(s) under provisions of Section 01 43 39 – MOCK-UPS.
- B. Provide mock-up using selected film types, minimum 16 square feet, illustrating color, texture and finish, and demonstrating the minimum standard for the Work.
- C. Locate mock-ups where directed.
- D. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
- E. Do not proceed with remaining work until mock-up is approved by Architect.
- F. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  - 2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
- B. Storage and Handling Requirements:
  - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.
  - 1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.
  - 2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL



1.10 SITE 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 limits.

1.11 WARRANTY

- A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Manufacturer Warranty: In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

**PART 2 - PRODUCTS**

2.1 GLAZING FILMS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on 3M Window Film, St. Paul, MN,
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  - 1. CPFilms, Inc., Martinsville, VA.
  - 2. Decorative Films, LLC, Frederick MD.
  - 3. 3M Window Film, St. Paul, MN.
- C. Glazing Film: 3M Window Film, St. Paul, MN., product: Fasara "Cielo", Frost/Matte pressure sensitive film, product number SH2FGCE, complying with the following criteria:
  - 1. Film Thickness 2.76 to 5.51 mil.
  - 2. Ultraviolet Rejected (ASTM E 903): Not less than 99 percent.
  - 3. Visible Light Transmittance (ASTM E 903, ASTM E308): Not more than 56 percent.
  - 4. Visible Light Reflectance (ASTM E 903): Not less than 26 percent.
  - 5. Shading Coefficient at 90 Degrees (Normal Incidence) (ASTM E 903): Not less than 0.74.

2.2 PERFORMANCE/DESIGN CRITERIA

- A. Fire Performance: Surface burning characteristics when tested in accordance ASTM E 84:
  - 1. Flame Spread: 25, maximum.
  - 2. Smoke Developed: 450, maximum.

### 2.3 ACCESSORIES

- A. Slip solution: Composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, or as otherwise recommended by glazing film manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Beginning of installation means acceptance of existing substrate and project conditions.

### 3.2 PREPARATION

- A. Surface Preparation: Clean surfaces thoroughly prior to installation.
  - 1. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 APPLICATION

- A. Install in accordance with manufacturer's instructions.
- B. Cut film edges neatly and square at a uniform distance of 1/8 inch to 1/16 inch of window sealant. Use new blade tips after 3 to 4 cuts.
- C. Spray slip solution on window glass and adhesive to facilitate proper positioning of film.
- D. Apply film to glass and lightly spray film with slip solution.
- E. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
- F. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
- G. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.

### 3.4 CLEANING

- A. Touch-up, repair or replace damaged products before Substantial Completion.
- B. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

End of Section

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Section 08 90 00  
LOUVERS AND VENTS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Prefinished aluminum exterior fixed louvers, complete with aluminum wire mesh bird screens, insect screens, insulated aluminum blank off panels, and related items, for indicated locations.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 07 92 00 - JOINT SEALANTS: Perimeter sealants and backing materials.
- D. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. AAMA 2605 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
  - 2. ASCA 96 - Voluntary Specification for Performance of Organic Coatings on Architectural Aluminum Curtainwall, Extrusions and Miscellaneous Aluminum Components.
  - 3. ASTM B 209 - Aluminum-Alloy Sheet and Plate.
  - 4. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:

1. ANSI/AMCA Standard 500-L - Laboratory Methods of Testing Louvers for Rating.
2. ANSI/AMCA Publication 501 - Application Manual for Air Louvers.
3. ANSI/AMCA Publication 511 – Certified Ratings Program Product Rating Manual for Air Control Devices..

#### 1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each type of louver and related components furnished hereunder.
  2. Manufacturer's sample warranties for louvers and finishes.
  3. Schedule: Schedule of all louvers to be furnished hereunder, indicating locations for each size and type of louver, and locations and sizes of blank off panels
  4. Shop drawings:
    - a. Large scale details of louver and blank off panel construction, indicating all sizes, gages, and thickness; large scale details of bird screens and accessory items; and complete installation details, coordinated to the specific receiving conditions. All details bearing dimensions of actual measurements taken at the project.
  5. Samples:
    - a. Sample card indicating Manufacturer's full range of colors available for selection by Architect.
    - b. 12 inch long finish samples of louver frame showing each type material finish and color selected specified.

#### 1.6 QUALITY ASSURANCE

- A. Perform work in accordance with AMCA Certification for louvers. Mark units with AMCA Certified Ratings Seal.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Store all materials in an elevated dry location, protected by waterproof coverings

#### 1.8 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
1. Louver manufacturer's standard warranty.
  2. Finish Warranty: 10 year warranty on louver finish which shall include covering the applied finish against defects, including color fading, chipping, crazing, pitting, and delamination.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Architectural Louvers (Harray, LLC), Cincinnati OH., model E4DP.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  - 1. Architectural Louvers (Harray, LLC), Cincinnati OH.
  - 2. Airo-lite Company, Schofield WI.
  - 3. Construction Specialties, Inc., Cranford NJ.
  - 4. Industrial Louvers, Inc., Delano MN.
  - 5. Greenheck Fan Corporation, Schofield, WI.
  - 6. Ruskin Louvers, Inc., Cincinnati OH.
  - 7. Cesco Products, Minneapolis MN.

### 2.2 ARCHITECTURAL LOUVERS

- A. General: Provide architectural louvers in the arrangements and dimensions shown on the Drawings.
- B. Architectural Louvers: Nominal 4 inch deep drainable architectural louvers in the arrangements and dimensions shown on the Drawings. Louvers shall be stationary, continuous blade, horizontal fixed, drainable louvers. Architectural Louvers, model E4DP, or approved equal in compliance with specified requirements.
  - 1. Nominal Louver depth: 4 inches (101.6 mm).
  - 2. Framing: Heads, sills, jambs and mullions to be one piece structural members of 6063-T5 alloy minimum 0.080 inch (2.03 mm) thick.
  - 3. Blades: 45 degree continuous design, minimum 0.080 inch (2.03 mm) thick with back lip.
    - a. Fabricate louver with close-fitting, field made splice joints in blades designed to permit expansion and contraction without deforming blades or framework and with mullions recessed from front edges of blades so blades have continuous appearance.
  - 4. Performance criteria:
    - a. Minimum Free Area: 52.7 percent (As determined in accordance with AMCA Standard 500, and certified by AMCA Standard 511).
    - b. Free Area: Not less than 8.0 sq. ft. (0.74 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
    - c. Point of Beginning Water Penetration: Not less than 925 fpm (4.7 m/s).
    - d. Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 800 fpm (4.1-m/s) free-area velocity.
    - e. Wind Loads: Determine loads based on a uniform pressure of 30 lb./sq. ft. (1435 Pa), acting inward or outward.

- C. Provide permanent and removable louver units or panels, as indicated on Drawings or as otherwise required by mechanical systems.
- D. Provide exterior corners which are prefabricated corner units having factory mitered and welded blades aligned with straight louver sections. Provide corners with concealed bracing.

### 2.3 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
- B. Louver Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.
- C. Louver Screening: Same kind of metal as indicated for louver.
  - 1. Insect Screening: Aluminum, 16 x 18 square mesh, 0.011-inch (0.28-mm) wire.
  - 2. Bird Screening: Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick.

### 2.4 ACCESSORIES

- A. Insulated blank-off panels: Fabricated from 0.060 inch thick aluminum insulated double wall sandwich construction, minimum 1-1/2 inches thick or as otherwise indicated on the Drawings and for blanking off unused portions of wall louvers.
  - 1. Finish (exposed to exterior): match louver frame.
- B. Fasteners and Anchors: Stainless steel type.
- C. Primer: Zinc chromate, alkyd type.
- D. Flashings: Of same material and factory finish as louver frame, minimum 0.032 inch thickness.
- E. Sealant: Joint Sealer Type SE as specified under Section 07 92 00 - JOINT SEALANTS.

### 2.5 FACTORY FINISHING

- A. Shop-applied Polyvinylidene Fluoride (PVDF) resin based, high performance thermoplastic organic coating conforming to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:
  - 1. Resin base of 70 percent PVDF by weight, Atochem North America, Inc., product "Kynar 500" or Ausimont USA. product "Hylar 5000".
  - 2. Finish Coating shall be manufactured as one of the following products:
    - a. Akzo Chemical; product "Trinar".
    - b. Glidden Company; product "Nubelar".
    - c. Morton International; product "Fluoroceram".
    - d. P.P.G. Industries Inc.; product "Duramar".
    - e. Valspar Corp., product: "Fluropon".

3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating, in accordance with Aluminum Association method AA-C12C42.
  4. Shop-prime all surfaces with a corrosion resistant, epoxy-based primer compatible with finish coating, averaging 0.2 to 0.4 mils dry film thickness, fully oven-cured.
  5. Shop finish with one color coat, of polyvinylidene fluoride enamel minimum 1.0 to 0.80 mil dry film thickness on all exposed surfaces, including all exposed screws, fastenings.
  6. Total system dry film thickness: 1.2 mils.
  7. Color and Appearance: Color shall be custom mixed, "non-exotic" color and shall match color sample furnished by Architect..
- B. Concealed Steel Items: Galvanized in accordance with ASTM A386 to 2.0 ounces per square foot.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that prepared openings and flashings are ready to receive the work of this Section and opening dimensions are as indicated on the shop drawings. Verify that all blocking and nailers are set in place and secure.
- B. Beginning of installation means acceptance of existing project conditions.

#### **3.2 INSTALLATION**

- A. Install louver assembly in accordance with manufacturer's instructions. Erect louvers plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.
1. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
  2. Secure louvers in opening framing with concealed fasteners.
  3. Secure louvers in opening framing with removable fasteners or hinged for maintenance purposes.
  4. Install bird screen and frame to interior of louver. Hinge screens for access.
- B. No permanent exposed to view labels of any kind will be permitted to remain on the louvers or frames.

#### **3.3 TOLERANCES**

- A. Maximum Variation from Level or Plumb: 0.06 inches every 3 feet non-cumulative or 0.5 inches per 100 feet, whichever is less.



3.4 CLEANING AND TOUCH UP

- A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- B. Remove excess sealant by solvent acceptable to sealant manufacturer. All exposed edges of sealant and gaskets shall be left smooth, uniform in line, and with edges neatly struck.
- C. Remove protective material from prefinished aluminum surfaces. Wash down exposed surfaces free of dirt, handling marks, packing tapes, and foreign matter, using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- D. Touch-up all scratches, abrasions, and other defects in the prefinished metal surfaces with shop-coat finish material, supplied with the various items to be furnished hereunder.

End of Section

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Section 09 01 23  
PLASTER PATCHING AND REPAIR

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Patch existing damaged, deteriorated and unsound lath, plaster and trim:
  - 1. Patch all existing lath, plaster and trim disturbed by new construction.
  - 2. Patch existing plaster assemblies scheduled to receive application of closed cell foam insulation.
  - 3. Patch all cracks in existing plastered surfaces which are to remain and which are indicated or required to be painted or receive a wall covering.
  - 4. Patching and replacement of missing plaster with three coat wet-plaster system where designated on the Drawings, as additionally identified and field, and as further directed by Architect. Work includes metal lath, plaster base coats and finish coat, trim accessories, and related items.
  - 5. Re-securing unsound and loose existing plaster to lath.
  - 6. Restoration of damaged ornamental plaster and decorative plaster molding; replace missing portions.
- B. Repair methods: The exact repair procedures shall be reviewed in the field, based on the guidelines and materials specified herein. Review all procedures with the Architect and obtain acceptance prior to commencing the work. Repair methods selected shall take into account the total construction system of the existing building.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION:
  - 1. Removal of existing finishes, partitions and walls as indicated in the Drawings.
  - 2. Removal of existing handrails in stairwells.
- D. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, and nailers.

- E. Section 06 20 00 - FINISH CARPENTRY: Installation of handrails in stairwells.
- F. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
- G. Section 09 29 00 - GYPSUM BOARD: Gypsum board partitions.
- H. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceilings.
- I. Section 09 91 00 - PAINTING: Applied Finish Coatings.

#### 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.
  - 1. ASTM C 28 - Gypsum Plaster.
  - 2. ASTM C 35 - Inorganic Aggregates for use in Gypsum Plaster.
  - 3. ASTM C 61 - Keene's Cement.
  - 4. ASTM C 206 - Finishing Hydrated Lime.
  - 5. ASTM C 631 - Bonding Compounds for Interior Plastering.
  - 6. ASTM C 842 - Application of Interior Gypsum Plaster.
  - 7. ASTM C 954 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.33 inches to 0.112 inches in Thickness.
  - 8. ASTM C 1002 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
  - 9. ASTM D 1784 - Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
  - 10. ASTM D 3678 - Rigid Poly(Vinyl Chloride) (PVC) Interior-Profile Extrusions.
  - 11. ASTM D 4216 - Rigid Poly(Vinyl Chloride) (PVC) and Related PVC and Chlorinated Poly(Vinyl Chloride) (CPVC) Building Products Compounds
  - 12. GA - Standard Specifications for Gypsum Plastering.
  - 13. NAAMM document ML/SFA 920 - Specifications for Metal Lathing and Furring.
  - 14. All applicable federal, state and municipal codes, laws and regulations for fire resistance and smoke ratings of interior finishes.
  - 15. United States Gypsum (or similar standards of other manufacturers whose products are used) Folder SA-917 - Plasters, Bases, and Accessories.

#### 1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
  - 2. Certificate: Manufacturer's certificate, that the products used meet or exceed specified requirements.

3. Samples:
  - a. Metal lath: 12-inch square piece of each specified type.
  - b. PVC accessories: 12-inch length of each type.
4. LEED Submittal Requirements:
  - a. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
    - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
      - a) The exposure scenario used to determine compliance.
      - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
      - c) Laboratory accreditation under ISO/IEC 17025.
      - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
    - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
    - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
  - b. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
    - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
      - a) The exposure scenario used to determine compliance.
      - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
      - c) Laboratory accreditation under ISO/IEC 17025.
      - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
    - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
    - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.

## 1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

B. Qualifications:

1. Applicator specializing in gypsum plaster Work with a minimum of 3 years documented experience.
2. Restoration Subcontractor: Work must be performed by a firm with not less than 10 years successful experience in comparable conservation plaster projects.
  - a. The restoration Subcontractor's workers shall skilled and experienced with the materials and requirements specified. The restoration Subcontractor shall maintain on site, full time a foreman/job superintendent having a minimum of 5 years documented successful experience in comparable plaster restoration projects of the type required for modifications and alternation of this project. Owner retains the right to review the foreman/job superintendent's qualifications and request for a more qualified person if the Owner deems necessary.

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable codes and UL requirements for fire rated assemblies in conjunction with both existing construction and Section 09 29 00 - GYPSUM BOARD.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Deliver plaster materials in original packages, containers or bundles bearing brand name, identification of manufacturer.
- C. Store materials inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, contamination, corrosion and damage from construction traffic and other causes.
- D. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.9 PROJECT CONDITIONS

- A. Do not apply plaster when substrate or ambient air temperature is less than 50 degrees Fahrenheit nor more than 80 degrees Fahrenheit.
- B. Maintain minimum ambient temperature of 50 degrees Fahrenheit degrees during and after installation of plaster, for the term of curing.
- C. Ensure that regulated ventilation will be provided during the application and curing period. Immediately report any unacceptable conditions to the Architect, requesting disposition therefore, and do not mix or apply plaster materials until all conditions are satisfactory and acceptable to the lathing and plastering applicator.

1.10 SEQUENCING AND SCHEDULING

- A. Do not install metal lath until all pipes, ducts, conduits, and other such items which are to be enclosed thereby, have been permanently installed, inspected and approved.
- B. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  - 1. Metal lath and accessories
    - a. United States Gypsum Company, Chicago IL.
    - b. National Gypsum Company, Gold Bond Products Division, Charlotte NC.
    - c. Georgia Pacific Corporation, Gypsum Division, Atlanta GA.
  - 2. Plaster Materials:
    - a. United States Gypsum Company, Chicago IL.
    - b. National Gypsum Company, Gold Bond Products Division, Charlotte NC.
    - c. Georgia Pacific Corporation, Gypsum Division, Atlanta GA.
  - 3. Polyvinyl chloride trim and accessories:
    - a. Plastic Components, Inc. (PC) Miami FL.
    - b. Vinyl Corporation, Miami FL.
    - c. Alabama Metal Industries Corporation, (AMICO) Birmingham, AL.

2.2 LATHING MATERIALS

- A. Diamond mesh lath: Expanded metal lath with (small diamond) 5/16 inch wide diamonds, prime painted, weighing 2.5 pounds per square yard and complying with ASTM C 847.

2.3 PLASTER MATERIALS

- A. Patching plasters: Gypsum plaster for patching work shall in general match existing plaster for texture and finish.
- B. Portland cement: Conforming to ASTM C 150, Type I or II.
- C. Lime: Pressure-hydrated finishing lime, conforming to ASTM C 206, Type S.
- D. Sand: Clean, sharp, free from alkali, salt, and quicksand, containing not more than 5 percent loam or clay, graded from coarse to fine, and conforming to ASTM C 35.

- E. Gypsum plaster for basecoats of gypsum gauging plaster finish: High strength gypsum plaster, conforming to ASTM C 28, USG Structo-Base Gypsum Plaster, or equal.
- F. Gypsum gauging plaster for finish coat: High strength gypsum gauging plaster, conforming to ASTM C 28, USG Structo-Gauge Gauging Plaster, or equal.
- G. Water: Clean, potable, and free from deleterious amounts of oils, salts, alkali, organic matter, and other foreign matter.

## 2.4 ACCESSORIES

- A. Galvanized steel accessories:
  - 1. Casings: 3/4 inch ground.
  - 2. Corner beads: Minimum 2 7/8 inch expanded flanges.
  - 3. Inside corner reinforcement: 4 inch strip of diamond mesh lath bent at the center to a 100 degree angle.
  - 4. Expansion joints: Double V with expanded flanges, 3/4 inch ground.
- B. Polyvinyl chloride accessories conforming to ASTM standards D-1784, D3678, and D-4216, for interior plaster work:
  - 1. Casings:
    - a. At patching work: PVC with depth of ground to match existing, 2 inch leg and 1/4 inch exposed flange.
  - 2. Straight Corner beads: PVC with 2-1/2 inch legs, or equal.
    - a. PC Model No. 1A.
    - b. Vinyl Corp.: Model No. 1.
    - c. (AMICO) Model No. AMX-1 ARCH.
  - 3. Expansion joints: PVC "M" profile, with depth to match existing plaster system.
    - a. PC Model No.. 2158X.
    - b. Vinyl Corp. Model No. 1558.
    - c. AMICO Model No. AMCJM-580.
  - 4. Expansion joints: PVC "V" profile, with removable tape, with depth to match existing plaster system. Provide with compatible control joint intersection trim pieces.
    - a. PC Model No. 2058.
    - b. Vinyl Corp. Model No. 1558X.
    - c. AMICO Model No. AMCJX-580.
- C. Wire for tying metal lath to itself, and for tying polyvinyl chloride accessories to lath: 18 gauge galvanized annealed steel wire.
- D. Fasteners: For attaching metal lath to concrete: Galvanized flat-head expansion screws, 1-1/4 inches long, equipped with 1/2-inch diameter galvanized steel washers.

## 2.5 PLASTER MIX

- A. Mix and proportion plaster in accordance with ANSI/ASTM C 842 and the plaster manufacturer's instructions.
  - 1. Use containers of known capacity, or by information contained on the specific packages, and accurately mix the materials.
  - 2. Do not use any lumpy or frozen materials in the mixes.
  - 3. Ensure that all mixing equipment, tubs, and tools are absolutely clean, before commencing the mixing operations.
  - 4. Use specified mix proportions, except where variations thereto would be more suitable due to prevailing conditions, and only when such variations are submitted to, and approved by, the Architect.
  - 5. Continue mixing process until all materials are evenly distributed and blended.
  - 6. Mix only the amount of material which may be applied within 2 hours.
- B. Scratch coat plaster: 2 cubic feet of sand per 100 pounds of specified basecoat plaster.
- C. Brown coat plaster: 3 cubic feet of sand per 100 pounds of specified basecoat plaster.
- D. Finish coat plaster: One part lime or lime putty and one part specified finish gauging plaster, with sufficient amount of water added to make the mix workable, in accordance with the manufacturer's recommendations.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Verify surfaces are flat, honeycomb is filled flush, and surface is ready to receive Work of this Section. Verify no bituminous, water repellent, or form release agents exist on concrete surface that are detrimental to plaster.
  - 2. Verify items within walls and above ceilings concealed by this Section, have been installed and inspected.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

### 3.2 PREPARATION

- A. During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.



### 3.3 PATCHING - GENERAL

- A. Patching of plaster shall match existing work in texture and finish, and at joining with plaster previously applied, shall finish flush and smooth. Heavy textured sandpaper or other abrasive shall not be used to clean or smooth off finished plaster surfaces.
- B. Remove deteriorated plaster from existing plastered surfaces which are to remain. Cut out deteriorated plaster to a point where sound plaster is encountered. Remove plaster base if base is found to be deteriorated.
- C. Install steel framing and metal lath as required to apply plaster for patching. Overlap new and existing lath at least 2 1/2 inches, and secure the two together every 6 inches on center.
- D. Apply 3 coat plaster system over metal lath. Plaster finish shall identically match existing plastered surface. Patch existing plastered ceilings so as to maintain fire resistance integrity of the entire ceiling.
- E. Patch holes or openings 1/2 inch or less in diameter, or equivalent size, with patching plaster.
- F. Through wall cracks on plastered surfaces shall be cut back to the base and 6 inches on each side of crack and attach wire lath to this area and replaster with scratch, brown and finish coats. Surface shall be flush and smooth with existing.

### 3.4 RESECURING PLASTER BY INJECTED ADHESIVE

- A. Determine the areas of loose plaster and mark them, review locations with Architect prior to commencing resecuring work.
- B. Ceilings (accessible from backside):
  - 1. From the backside of the surface to be repaired, drill 1/4 inch injection holes through the lath 3-6 inches apart and at the center of the lath. Remove dust and debris from injection holes.
  - 2. Inject adhesive primer into holes according to manufacturer's directions. Inject adhesive into the pre-drilled holes, giving the adhesive enough time to flow into the space between the plaster and the lath.
  - 3. Brace plaster with a 1/2 inch layer of foam carpet and a layer of supporting plywood.
  - 4. When the adhesive has set, carefully remove bracing materials.
  - 5. Fill holes and/or tape and mud cracks and finish as required.
- C. Ceilings (inaccessible backside) and Walls: Drill through plaster and lath with holes 3-6 inches apart, and if possible, through the center of the lath.
  - 1. In walls, break-the plaster open at the bottom of areas where performing resecuring work. Vacuum debris from broken plaster keys.
  - 2. Inject adhesive primer into holes according to manufacturer's directions.
  - 3. Inject adhesive primer into holes according to manufacturer's directions. Inject adhesive into the pre-drilled holes, giving the adhesive enough time to flow into the space between the plaster and the lath.

4. Brace plaster with a 1/2 inch layer of foam carpet and a layer of supporting plywood.
5. When the adhesive has set, carefully remove bracing materials.
6. Fill holes and/or tape and mud cracks and finish as required.

### 3.5 RESECURING LOOSE PLASTER WITH PLASTER WASHERS

- A. Resecuring Loose Plaster with Plaster Washers: use plaster washers (to pull sound plaster back up to the lath (when the keys have broken), or to pull plaster and lath back to the studs or joists.
  1. Identify locations of wood framing, measure and mark their locations. From plaster side, drive stainless steel screws fitted with plaster washers into joists approximately 4 inches on center where sagging is apparent or as close as necessary. Tighten screws sequencing from edge to in-plane areas.
  2. Patch all holes and finish smooth with surrounding areas.

### 3.6 INSTALLATION OF LATH AND ACCESSORIES

- A. Install lath in accordance with GA-201.
  1. Apply metal lath taut, with long dimension perpendicular to supports.
  2. Lap ends minimum 1 inch (25 mm). Secure end laps with tie wire where they occur between supports.
  3. Lap sides of diamond mesh lath minimum 1-1/2 inches (38 mm). Nest outside ribs of rib lath together.
  4. Lap adjacent edges of lath a minimum of 1 inch; Secure lapped edges with wire ties at 6 inches on center.
- B. Attach lath to concrete/masonry substrates with specified expansion screws, equipped with washers, spacing the screws not more than 6 inches on centers, vertical dimension, and not more than 24 inches on centers, horizontal dimension.
- C. Attach metal lath to metal supports using tie wire at maximum 6 inches (150 mm) on center.
  1. Place lath vertically above each top corner and each side of door [and glazed] frames to 6 inches (150 mm) above ceiling line.
  2. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
  3. Place 4 inch wide strips of metal lath centered over junctions of dissimilar backing materials. Secure metal lath with wire ties spaced 6 inches on center.
- D. Attach metal lath to wood supports using nails at maximum [xxx] inches on center.
  1. Place lath vertically above each top corner and each side of door [and glazed] frames to 6 inches (150 mm) above ceiling line.
  2. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
  3. Place 4 inch wide strips of metal lath centered over junctions of dissimilar backing materials. Secure metal lath with wire ties spaced 6 inches on center.

### 3.7 INSTALLATION OF CASINGS AND TRIM

- A. Casings: Install specified casings at perimeters of each plaster area which abuts a dissimilar material; around major openings in plaster surfaces; and in other locations so indicated on the Drawings.
  - 1. Place casing beads at terminations of plaster finish. Butt and align ends, set level, and at the proper height to receive the required thickness of plaster. Secure with wire ties spaced 6 inches on center.
  - 2. Set casings plumb and level, and at the proper height to receive the required thickness of plaster.
- B. Corner beads: Install specified corner beads at external corners of plaster areas. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches (75 mm) from the corner to form the angle reinforcement; fasten at perimeter edges only.
  - 1. Secure the beaded external angle with mesh, butt and align ends, secure to metal lath with specified tie wires at outer edges of lath spaced not more than 6 inches on centers.
  - 2. Set corner beads plumb, and at the proper height to receive the required thickness of plaster.
- C. Place base screeds at termination of plaster areas; secure rigidly in place.
- D. Expansion joints: Install specified expansion joints, at locations to be determined by the Architect, wherever a continuous run of plaster surface exceeds 20 feet in any direction.
  - 1. Secure the expansion joints to metal lath with specified tie wires spaced not more than 6 inches on centers.

### 3.8 APPLICATION OF GYPSUM PLASTER

- A. Scratch coat: Apply with sufficient material and pressure to cover well and key into the lath, than scratch to a rough surface to provide proper bond for the brown coat.
- B. Brown coat:
  - 1. Apply brown coat not sooner than 48 hours after installation of scratch coat.
  - 2. Apply brown coat to the firm and hard scratch coat, spreading the brown coat over an entire elevation, smooth without laps, in a thickness of not less than 1/4-inch over the scratch coat, and bring to a straight and true plane by rodding in every direction. Ensure that sufficient material is applied to provide a total scratch/brown coat thickness of approximately 5/8 inch. Leave surface of the brown coat rough for proper bonding of the finish coat.
- C. Finish coat:
  - 1. Conditions where finish coat is required:
    - a. All exposed to view conditions.
    - b. All concealed conditions behind built-in cabinets, furnishings, and equipment.
  - 2. Conditions where finish coat is not required:

- a. Where plaster application will be concealed above suspended ceilings and in similar locations, finish coat may be omitted.
  - b. Where plaster application will be used as a base for adhesive application of tile and similar finishes, finish coat may be omitted.
3. Application of Finish Coat:
- a. Applied not sooner than 7 days after installation of brown coat.
  - b. Apply the finish coat to an entire elevation, smooth without laps, in a thickness of 1/8 to 1/4-inch over the brown coat, and steel-trowel the surface. Double-back as necessary to provide a uniformly smooth dense finish, free from blemishes, surface defects and irregularities. All lines and arises shall be straight, plumb and level.
  - c. Where plaster is finished flush with metal trim or other materials, cut a small straight V-joint in finish coat of plaster at the intersection.
- D. Total thickness of base coats and finish coats: Not less than 3/4 inch.
- 3.9 TOLERANCES
- A. Maximum Variation from true flatness 1/8 inch (3 mm) in 10 feet (3 m).
  - B. Maximum Variation from true position 1/8 inch (3mm).
- 3.10 PLASTER REPAIR
- A. Inspect all gypsum plaster surfaces and correct conditions which do not meet specified requirements.
  - B. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.
- 3.11 CLEANING UP
- A. Daily clean work areas by sweeping and disposing of debris.
  - B. After completion of plaster work, remove equipment, and clean all wall, partition, and floor areas free from deposits of plaster, lath, and other materials installed under this Section.

End of Section

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Section 09 01 66  
REFINISHING WOOD FLOORS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Perform complete sanding and finishing operations for exposed to view surfaces of all existing wood strip flooring scheduled to remain in place, including flooring patches, and wood edgings furnished hereunder.
  - 1. As part of the scope of this section, patch to match existing wood strip flooring as required.

1.3 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete substrate.
- B. Section 09 91 00 - PAINTING: Field applied surface finish to flooring.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
  - 2. FS MM-L-736 - Lumber; Hardwood.
  - 3. WSFI - Recommendations for the Correct Preparation, Finishing, and Testing of Concrete Subfloor Surfaces to Receive Wood Flooring.
  - 4. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Literature: Manufacturer's product data sheets, specifications, performance data for each type of wood flooring [and finish system] materials, with manufacturer's installation instructions and recommended maintenance procedures.
  - 2. Installation instructions: Submit manufacturer's instructions, indicating special procedures, and perimeter conditions requiring special attention.

3. Manufacturer's warranties: Wood flooring and finish system manufacturers' standard written guarantees covering defects in materials and workmanship, clearly defining the terms included in the coverage.
  4. Shop drawings: Indicate floor joint pattern and termination details.
  5. Verification samples:
    - a. Strip flooring: At least six (6) 12-inch long pieces of specified specie, grade, and size of flooring, indicating complete range of color variation which may be expected for the project.
    - b. 12 x 12 inch sample of Repurposed Gym Floor (over plywood) with eggshell, semi-gloss and gloss finish for architect selection (3 samples). Each sample board must contain one area of existing paint striping for reference.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Maintenance data: Include maintenance procedures, recommended maintenance materials, a suggested schedule for cleaning, stripping, and re-finishing, stain removal methods, and polishes and waxes.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer: Companies specializing in manufacturing the products specified in this Section, each with minimum 5 years documented experience.
- B. Installer specializing in applying the work of this Section with a minimum of 5 years documented experience of the type of flooring system specified.
- C. Each board of flooring shall bear grade stamp on underside identifying Grading authority, manufacturer's identification, wood species and grade.

#### 1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for Class 1 flame spread rating of finished floor surface when tested in accordance with ASTM E 84. Provide certificate of compliance from authority having jurisdiction.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver wood flooring a minimum of 7 days prior to installation to allow materials moisture content to stabilize to ambient conditions. Do not deliver wood until all concrete, masonry, plaster and other wet work is complete and dry, and ambient air at installation space has moisture content stabilized.
- B. Protect wood flooring from excessive moisture in shipment and handling; store all materials in an elevated, protected, and dry location.

#### 1.9 PROJECT CONDITIONS

- A. Maintain ambient temperature between 55 and 80 degrees Fahrenheit, with a relative humidity of between 35 and 50 percent for 48 hours prior to delivery and storage of the flooring materials at the area; maintain such conditions throughout the installation and finishing period, and thereafter until Owner's Final Acceptance or Owner's occupancy.

1.10 SEQUENCING AND SCHEDULING

- A. Sequence work to ensure wood flooring is not delivered until building is enclosed, sufficient heat is provided, and proper humidity conditions can be maintained.
- B. Install wood flooring after interior wet work is complete and fully cured, and ambient air at installation space has a moisture content stabilized.

1.11 WARRANTY

- A. Provide 5 year warranty under provisions of the Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall include coverage for all costs to repair or replace flooring, which shrinks, warps, cracks, or otherwise deteriorates excessively, or which breaks its anchorage, or bond with substrate, or otherwise fails. Warranty shall cover failures due to materials or workmanship. The Installer is not responsible for failure due to excessive moisture penetration through concrete substrate or other similar causes for failure which are beyond the Work of this Section, except verification of acceptable substrates, specified herein.

1.12 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, an amount equal to [10] square feet of finish and type flooring installed, with an appropriate quantity of adhesive for installation.
- B. Clearly label and package extra materials securely to prevent damage.

**PART 2 - PRODUCTS**

2.1 MATERIALS

- A. Finishing:
  - 1. Sandpapers: Number 1-1/2 graduating to 1/2; followed by Numbers 0 and 00 for final sanding, except as otherwise recommended by the flooring manufacturer.
  - 2. Filler: Paste wood filler, in tone as selected by the Architect.
  - 3. Floor finish: Water base catalyzed urethane coating system, as manufactured by Basic Coatings, Des Moines IA., product "Street ShoeXL Commercial Wood Floor Finish".
    - a. VOC: Catalyzed, not exceed 350 grams per liter.
    - b. Solids content: 31 percent.
    - c. Luster Satin finish, 30 units at 60 degrees on wood.

2.2 ACCESSORIES

- A. Protection paper: Waxed kraft paper. or red rosin paper.
- B. Fasteners:
  - 1. Fasteners for plywood underlayment: Power-actuated fasteners of appropriate size for the specific substrate.



2. Fasteners for flooring: 7d or 8d cut nails or screw-type nails, or other fasteners as recommended by the flooring manufacturer, for blind-method installation over plywood underlayment.
- C. Filler for patching, smoothing and leveling subfloors and underlayment: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
  1. Ardex, Inc., products "Feather Flash" and "Ardex SD-P".
  2. Quikrete Companies, product "Fast-Set Underlayment 1248".
  3. Silpro Masonry Systems Inc., product "Masco Latex Cement"

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify concrete substrate has cured for at least 60 days. Test concrete with 3 percent solution of phenolphthalein in grain alcohol for dryness. Do not proceed with installation until substrate passes dryness test, immediately notify Architect of unacceptable substrate conditions.
- B. Verify that permanent heat, light, and ventilation is complete and operational prior to installation.
- C. Inspect all substrate surfaces and verify that they are in proper condition to receive the work of this Section.
  1. Verify that concrete substrate surfaces are smooth and flat to plus or minus 1/8 inch in 10 feet, free of scaling, oil, grease, dust, and foreign substance.
  2. Verify that wood subfloor is properly secured, is smooth and flat to plus or minus 1/8 inch in 10 feet, free of foreign substances.
- D. Verify that required flooring mounted utilities are in proper location.
- E. Beginning of installation means acceptance of existing substrate and site conditions.

#### **3.2 PREPARATION**

- A. Comply with flooring manufacturer's requirements for preparation of substrate to receive wood flooring.
- B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. Thoroughly vacuum clean / broom-clean all receiving surfaces before commencing installation work.
- D. Open bundles of flooring, and permit the pieces to properly acclimatize prior to installing same.

#### **3.3 INSTALLATION / PATCHING OF IN SITU FLOORING**

- A. Remove existing floor board to be replaced by cutting with a saw as follows:

1. Set saw at a depth not to exceed the thickness of the existing flooring making two passes approximately 1/2 inch from each side of the adjacent floor boards.
  2. Do not cut past the end joints of the piece being replaced.
  3. Create a third cut on an angle between the first two cuts avoid cutting through the side match. Use a sharp chisel to remove the cut pieces.
  4. Clean and vacuum the groove and area around the repair, making sure all debris is removed.
- B. Install replacement flooring:
1. Cut the replacement piece of flooring to the exact length and ensure a tight fit with no cracks at the end joints.
  2. Remove the bottom of the groove of the replacement board. Bevel each end of the board. Dry fit the replacement piece before installation.
  3. Install the replacement board using a two-part epoxy adhesive recommended by the flooring manufacturer. Apply adhesive in the groove and on the tongue of the existing boards adjoining the repair and the tongue and groove on the replacement piece. Allow adhesive to set for a minimum of 8 hours prior to sanding and refinishing.

#### 3.4 REFINISHING EXISTING FLOORING

- A. Nail loose boards and patch existing flooring with wood plugs.
- B. Remove dirt and built-up waxes by wiping floors with mop or cloth moistened with mineral spirits, or sealer as recommended by Maple Flooring Manufacturers Association and sealer/finish manufacturer, and immediately wipe dry. Remove white spots using specialized wood floor cleaners; remove all rubber heel marks, wipe areas dry.
1. Review with Architect in field stained areas of existing flooring, lightly sand where directed to remove stains.
- C. Touch-up existing finish staining to match color and shade, and allow to thoroughly dry.

#### 3.5 FINISHING

- A. Prior to commencing application of finishing products, measure moisture content of flooring using moisture meter, and record results.
- B. Stain wood to color and tone to match architect's accepted sample, applying stain at approximately 100 square feet per gallon; allow stain to fully dry, verify with moisture meter.
- C. When stain has cured, apply one coat of Basic Coatings product "Hydroliner sealer" as recommended by manufacturer. When that moisture content of wood is same as original prior to application, sand/buff coat with a used 120 grit screen.
- D. Vacuum up all dust and tack with a clean water dampened towel. Apply second coat of sealer and, repeat sanding and cleaning procedures.

- E. Permit sealer to dry overnight prior to finishing with catalyzed urethane. Re-sand and clean as required.
- F. Mix catalyst with urethane in strict adherence to manufacturers' instructions. Apply one coat of catalyzed urethane with a coverage rate as recommended by manufacturer. When manufacturer recommends first coat should be dry, check the moisture content of wood. When moisture content is same as original prior to application, sand with used 120 grit screen, clean and apply second coat. This should occur between 3 and 5 hours after first coat. If more than 5 hours has lapsed prior to starting the second coat of urethane, repeat sanding and cleaning procedures specified above and apply second coat.

### 3.6 CLEANING

- A. Daily clean work areas by sweeping and disposing of scraps and sawdust.
- B. As work progresses, remove excess adhesive from floor, base and wall surfaces without damage.
- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- D. Clean and polish floor surfaces in accordance with manufacturer's instructions.

### 3.7 PROTECTION

- A. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Prohibit construction traffic for a minimum of 48 hours on completed areas of adhesive applied flooring.
- B. Cover the all wood floor surfaces, facings, and edgings, with heavyweight non-staining kraft paper and overlay with red-rosin paper, taping the edges to maintain position of the protection paper. Reapply papers as required to maintain floor protection.

End of Section

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Section 09 01 69  
TERRAZZO RESTORATION

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of restoration of terrazzo finish where shown on the Drawings, as specified herein, and as required for a complete and proper installation.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing partitions located over terrazzo flooring.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.
  - 1. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
  - 2. ASTM C33 - Concrete Aggregates.
  - 3. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
  - 4. ASTM C150 - Portland Cement.
  - 5. ASTM D2103 - Polyethylene Film and Sheeting.
  - 6. NTMA - published standards and specifications.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
  - 2. Shop drawings:

- a. 1/4 inch scale plans of each terrazzo area indicating layout of: divider strips, control joints, and expansion joints.
  - b. Large scale details of joints with adjacent components, and expansion joints.
  3. Samples:
    - a. Two 6 inch length samples of control joints and expansion joints.
    - b. Two samples 12 x 12 inch in size illustrating chip size variation, color mix, and mortar color.
  4. LEED Submittal Requirements:
    - a. Indoor Environmental Quality Credit 3: Low-Emitting Materials (flooring systems):
      - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
        - a) The exposure scenario used to determine compliance.
        - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
        - c) Laboratory accreditation under ISO/IEC 17025.
        - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
      - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for flooring systems installed within the waterproofing membrane.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Cleaning and maintenance data. Include procedures for stain removal, stripping, sealing, and waxing.
- 1.6 QUALITY ASSURANCE
- A. Installer, with a minimum of 5 years documented experience demonstrating previously successful work of the type specified herein.
- 1.7 MOCK-UP
- A. Provide a mockup under the provisions of Division 1, GENERAL REQUIREMENTS; to demonstrate the minimum standard for the Work of this Section, including chip size variation, color mix, mortar color, ground top surface of divider strip, and finishing. The mockup shall be in a location approved by Architect and be 4 by 4 feet minimum of terrazzo flooring and 4 lineal feet of border. Mockup will be reviewed and approved by the Architect; accepted sample may remain as part of the Work; rejected mockups will be removed entirely.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Store all materials in an elevated dry location, protected by waterproof coverings.

1.9 ENVIRONMENTAL CONDITIONS

- A. Do not install wet mixed terrazzo when temperature is below 50 degrees Fahrenheit or above 90 degrees Fahrenheit. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of terrazzo.
- B. Ventilate spaces where work of this Section occurs, during and for a period of 72 hours after completion of curing. Ventilate to dissipate humidity, and to prevent accumulation of fumes, vapors, and gases. Provide temporary fan units and ducting as required to for venting operations

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the Work of this Section with the respective trades responsible for installing interfacing work, and ensure that the Work performed hereunder is acceptable to such trades for the installation of their work.

**PART 2 - PRODUCTS**

2.1 MATERIALS

- A. Portland Cement: ASTM C150, Type 1 normal modified to NTMA higher compressive strength requirements; obtained from single source.
  - 1. White or gray color as required to match existing matrix.
- B. Color pigments for topping: Non-fading mineral type.
- C. Sand: ASTM C33; sharp, coarse, clean, screened, and free of deleterious material.
- D. Water: Potable.
- E. Surface Aggregate: Crushed marble, granite, quartz, Number 1 to 2 size in accordance with NTMA chip size for standard gradation and uniform coloration.

2.2 ACCESSORIES

- A. Divider Strips: 1/8 inch thick solid zinc top strip with triple-coated zinc coated steel, 1-3/4 inches deep, with anchoring features.
- B. Control Joint Strips: Nominal 1/8 width solid zinc strip with triple-coated zinc coated steel bottom strip, 1/8 inch wide neoprene filler strip between vertical strips, with anchoring features.
- C. Strip Height; To suit thickness of terrazzo topping, with allowance for grinding.
- D. Base Caps, Base Divider Strips, and separator strips: Match divider strips.
- E. Foam filler: Closed cell urethane foam, capable of compression to 50 percent of its thickness with full recovery.
- F. Slip sheet: ASTM D2103; 4 mil polyethylene sheet.
- G. Non-slip Inserts: White alloy zinc, 3/8 x 3/8 inches x 20 gage dove-tail shaped channels, with anchors; filled with carborundum non slip filler.

- H. Curing Compound: ASTM C309.
- I. Cleaning: Neutralizing liquid type, pH of 7.
- J. Sealer: Colorless, penetrating liquid type to completely seal cementitious matrix surface; not detrimental to terrazzo components.
- K. Wax: Colorless paste type.
- L. Subfloor Filler: Latex type.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that field measurements are as shown on shop drawings.
- B. Do not begin terrazzo work until concrete substrate has cured 28 days, minimum.
- C. Beginning of installation means acceptance of existing site conditions.

#### **3.2 PATCHING**

- A. Cleanly cut existing floor for installation of divider strips at junction with new terrazzo flooring. Locate where indicated, or where not indicated where approved by Architect in field. Patch existing flooring to match existing.

#### **3.3 REFINISHING OF EXISTING TERRAZZO:**

- A. Grind with 80 or finer grit stones in the presence of water.
- B. Grouting and polishing:
  - 1. Clean existing terrazzo floor. Protect other finished floor and wall surfaces. Rinse with clean water.
  - 2. Remove excess rinse water and machine or hand-apply grout using a cement/acrylic with or without color added as required to match the matrix of the existing Terrazzo floor. Fill all voids and honeycomb exposed during grinding.
  - 3. Use curing method in accordance with NTMA instructions. Barricade area to allow undisturbed curing. After grout has sufficiently cured (a minimum of 72 hours), grind, using a fine grit abrasive.
  - 4. Grind cured grout with 80 or finer grit stones until all grout has been removed from the Terrazzo surface.

#### **3.4 TOLERANCES**

- A. Maximum variation from flat surface 1/8 inch in 10 feet. Maximum variation from level (except surfaces sloping to drain) 1/8 inch.

#### **3.5 CLEANING**

- A. Scrub and clean terrazzo surfaces with cleaner in accordance with NTMA instructions; let dry. Immediately when dry, apply sealer in accordance with

manufacturer's instructions. Wax and polish surfaces in accordance with manufacturer's instructions.

- B. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of materials installed under this Section.

### 3.6 PROTECTION

- A. During the operation of terrazzo work, protect the work of other trades against undue soilage, damage, or disfigurement by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.
- B. After completion of the work of this Section, protect finished floors with heavy duty red-rosin paper or kraft paper. Reapply torn or damaged protection paper.

End of Section



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Section 09 05 60  
COMMON WORK RESULTS FOR FLOORING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. This Section includes general requirements for flooring preparation, installation and temporary protection
  - 1. Provide independent testing laboratory services to perform relative humidity, moisture vapor emission, and pH tests on in situ concrete slabs, which shall be in addition to testing as may be performed by Owner.
  - 2. Prepare substrates to receive resilient tile flooring as required to ensure specified tolerance level for finish surface of floor tile. Preparation work includes patching, smoothing and leveling substrate, including:
    - a. Grinding down high spots of substrate.
    - b. Providing Portland cement-based latex underlayment (filler).
    - c. Provide localized floor leveling at door openings.
  - 3. Self-leveling underlayment (as required) for adjustment of floor heights up to 1 inch maximum.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 03 01 36 - RESURFACING AND PATCHING OF CONCRETE SLABS.
- D. Section 03 33 00 – CAST-IN-PLACE CONCRETE: Concrete floor slab substrate.
- E. Section 06 10 00 - ROUGH CARPENTRY: Plywood underlayment.
- F. Section 09 64 33 - LAMINATED WOOD FLOORING.
- G. Section 09 65 19 - RESILIENT TILE FLOORING: Resilient tile and plank flooring.
- H. Section 09 65 66 - RESILIENT ATHLETIC FLOORING: Resilient athletic flooring.
- I. Section 09 68 13 – TILE CARPETING: Carpet tile and transition strips.

#### 1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. ASTM D 4259 - Standard Practice for Abrading Concrete.
1. ACI 302 - Guide for Concrete Floor and Slab Construction.
  2. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
  3. ASTM C33 - Concrete Aggregates.
  4. ASTM C150 - Portland Cement.
  5. ASTM C472 Compressive Strength
  6. ASTM C1708 – Self-leveling Mortars Containing Hydraulic Cements.
  7. ASTM D4263 Standard test method for indicating moisture in concrete
  8. ASTM E1907 - Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
  9. ASTM E329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
  10. ASTM E492 Impact Insulation Class (IIC)
  11. ASTM E90 Sound Transmission Class (STC)
  12. ASTM F710 - Preparing Concrete Floors to Receive Resilient Flooring.
  13. ASTM F1482 - Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.
  14. ASTM F1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
  15. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes
  16. ASTM F3010 - Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.
  17. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate flooring work with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-Installation Meetings: At least 30 calendar days prior to commencing any flooring work, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees:
    - a. Owner.
    - b. Architect.
    - c. Construction Manager.
    - d. General Contractor.
    - e. Project Superintendents representing each floor system installer.
    - f. Manufacturer's technical representative(s) for flooring products as designated by Architect or Contractor.
    - g. Representatives of related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
      - 1) Section 03 01 36 - Resurfacing and Patching of Concrete Slabs.
      - 2) Section 09 65 19 - Resilient Tile Flooring.
      - 3) Section 09 65 66 - Resilient Athletic Flooring.
      - 4) Section 09 68 13 – Tile Carpeting.
  2. Agenda:
    - a. Scheduling of preparation and flooring operations.
    - b. Procedures for testing of relative humidity and moisture content of in situ substrates.
    - c. Water vapor emission control methods.
    - d. Review of staging and material storage locations.
    - e. Coordination of work by other trades.
    - f. Protection of completed Work.
    - g. Establish humidity and temperature limitations for performing the work, to which Architect and Contractor must agree.
    - h. Discuss process for inspection and acceptance of completed Work of this Section.
- C. Sequencing:
1. Sequence work to ensure flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
  2. Sequence flooring installation when base cabinets or other built-in casework is present on the substrate.
  3. Field Measurements
    - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
    - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
  4. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Test and Evaluation Reports: Include the following:
    - a. Report the test deployment parameters at start of testing and finishing of testing:
      - 1) Start and finish dates and times of testing.
      - 2) Ambient temperature.
      - 3) Ambient relative humidity and dew point temperature.
      - 4) Minimum and maximum ambient temperature and relative humidity reached during testing.
    - b. Report the "factor" used to calculate the actual test area of the calcium chloride test site.
    - c. Report the concrete slab thickness (in inches).
    - d. Report the Demolition Parameters for moisture vapor emission (MVER) testing: The start and finish date and time of removing existing non-asbestos flooring and adhesives, prior to MVER testing.
    - e. Report all test results in chart form listing the following:
      - 1) Test locations (also mark test locations on floor plan).
      - 2) Type(s) of existing floor coverings.
      - 3) Visual distress level of existing floor coverings.
      - 4) Surface temperature of concrete.
      - 5) pH paper/ pencil reading (ASTM F 710).
      - 6) Visual appearance of concrete.
      - 7) Concrete slab age.
      - 8) Relative humidity in concrete, % (ASTM F 2170):
        - a) Depth of hole from top of slab, inches.
        - b) RH in concrete, %.
        - c) Temperature in concrete, °F.
      - 9) Surface moisture meter test (ASTM E 1907):
        - a) Electrical impedance test values.
        - b) Electrical resistance test values.
      - 10) Moisture vapor emission (MVER) - CaC12 test (ASTM F 1869):
        - a) Weight gain in grams.
        - b) Exposure time/hours.
        - c) MVER Lbs/1000 sq. ft./24 hours.
    - f. Report all unacceptable substrate and field conditions observed during testing.
- B. Submit 1 copy of test data to the installers of all flooring materials or floor surface coating materials scheduled to be installed.

## 1.7 QUALITY ASSURANCE

- A. General: perform relative humidity, moisture vapor emission (MVER) and acidity/alkalinity (pH) Testing for concrete slabs and floors.

1. Construction Manager shall employ and pay for services of an independent testing laboratory to perform relative humidity, moisture vapor emission, and pH tests on concrete slabs as follows. The test shall be witnessed by the Construction Manager flooring subcontractors and Owner's Project Representative.
  - a. Relative Humidity, Moisture Vapor Emission and pH Testing on all concrete slabs over-which a finished floor is to be installed. This includes, but is not limited to:
    - 1) Resilient flooring.
    - 2) Static dissipative flooring.
    - 3) Painted floors and concrete sealers.
    - 4) Carpet.
    - 5) Terrazzo (excluding sand-bed terrazzo systems).
  - b. Perform moisture and pH tests on all concrete floors over-which stone flooring is to be applied.
2. Testing Requirements: As specified under Part 3 of this Section.
  - a. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products.
    - 1) Perform additional testing after procedures have been performed by the Construction Manager to reduce moisture content to ratings acceptable to the various flooring and floor-coating manufacturers. Construction Manager's procedures to reduce moisture content may consist of project dehumidification and temporary heating, environmental controls, or moisture mitigation treatment to concrete.

## 1.8 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 43 39 – MOCK-UPS.
- B. Provide mock-up areas using accepted floor leveling materials, minimum six square feet per side of each door opening mock-ups, demonstrating the minimum standard for the Work. Multiple floor leveling mock-ups will be required, as determined in field.
  1. All floor leveling mock-ups to be two staged requiring to be reviewed and approved prior to installation of finish flooring, with a second review having applied finish flooring.
    - a. Locate one floor-leveling mock-up at Model Bedroom.
  2. Accepted mock-ups may remain as part of the work.

## PART 2 - PRODUCTS

### 2.1 GENERAL FLOORING ACCESSORIES

- A. Filler for patching, smoothing and leveling subfloors and underlayments: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
  1. Ardex Americas, Aliquippa, PA., products "Feather Flash" and "Ardex SD-P".

2. Quikrete Companies., Atlanta, GA., product "Fast-Set Underlayment 1248".
  3. Silpro Corp., Ayer MA., product "Profinish".
- B. Adhered flooring systems general requirements for adhesives (except as otherwise specified in individual Specification Sections):
1. General Flooring Adhesives: High moisture resistant and alkali resistant adhesive: Synthetic Polymer, non-flammable in wet state, with NFPA, Class A rated, VOC compliant, capable of withstanding the following in continuous service:
    - a. Up to 90% relative humidity when measured in accordance with ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in-situ Probes.
    - b. Up to 8 lbs./1000 sq. ft./ 24 hours MVER when measured in accordance with ASTM F1869 - Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
    - c. VOC content: Less than 50 g/L.
  2. Acceptable adhesives, include the following, or approved equal, (subject to acceptance of flooring manufacturer for performance and compliance with warranty requirements, for each type of floor system specified):
    - a. Advanced Adhesive Technology Inc., Dalton GA.
      - 1) Adhesive: "AAT-270" (maximum 80% RH / 3 pounds MVER).
      - 2) Adhesive: "AAT-675" (maximum 85% RH / 5 pounds MVER).
    - b. Armstrong World Industries, Inc., Flooring Division, Lancaster PA., adhesive: "S-515" (maximum 90% RH / 5 pounds MVER).
    - c. DriTac Corp., Clifton NJ., adhesive: "5900 Mega Bond" (maximum 90% RH / 8 pounds MVER).
    - d. W.W. Henry Company, Aliquippa PA.
      - 1) Adhesive: "640 Vinyllock" (maximum 90% RH / 3 pounds MVER).
      - 2) Adhesive: "430 ClearPro" (maximum 90% RH / 8 pounds MVER).
    - e. Johnsonite, Middlefield OH., adhesive: "SpraySmart" (maximum 90% RH / 8 pounds MVER).
    - f. Mapei Corporation, Elk Grove IL:
      - 1) Adhesive: "Ultrabond ECO 360" (maximum 80% RH / 5 pounds MVER).
      - 2) Adhesive: "Ultrabond ECO 711" (maximum 95% RH / 8 pounds MVER).
    - g. Roberts Consolidated Industries, Inc., City of Industry, CA., adhesive: 7350 (maximum 90% RH / 10 pounds MVER).
    - h. Titebond, Columbus, OH., adhesive "Titebond 670 Resilient Flooring Adhesive" (maximum 90% RH / 8 pounds MVER).

## 2.2 SELF-LEVELING CEMENTITIOUS UNDERLAYMENT

- A. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Ardex Americas, Aliquippa, PA.

2. Maxxon Corporation, Hamel MN,
  3. Quikrete Company, Atlanta GA.
  4. Silpro Masonry Systems Inc., Ayer MA.
- B. Underlayment:
1. Ardex product "Ardex K-55 Microtec".
  2. Maxxon Corporation, product "LevelRight WearTop".
  3. Silpro Masonry Systems Inc., product: "Silflo 230".
- C. Primer: As recommended by underlayment manufacturer for intended substrate.
- D. Water: Clean potable and cooler than 70 degrees Fahrenheit.
1. Use minimum amount of water necessary to produce a workable mix.

### 2.3 TESTING EQUIPMENT

- A. For relative humidity testing: Digital Meter and Calibrated Humidity and Temperature probe kit in Compliance with ASTM F 2170.
- a. Minimum 2 point probe calibration.
- B. For calcium chloride testing: Anhydrous calcium chloride testing in accordance with Rubber Manufacturer's Association (RMA) Test requirements and in compliance with ASTM F 1869.
- C. For pH testing: In compliance with ASTM F710.
1. pH test paper.
  2. Distilled or de ionized water.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that spaces to receive flooring finishes are suitable for installation. Do not proceed with work until unsatisfactory conditions are corrected. Comply with manufacturer's recommendations including the following:
1. Substrates shall be dry and clean.
  2. Substrates shall be free of depressions, raised areas, or other defects which would telegraph through installed flooring.
  3. Verify concrete substrates have a flat tolerance of 3/16" in 10 linear feet, or more restrictive tolerances as specified under individual flooring Specification Sections.
  4. Temperature of flooring and substrate shall be within specified tolerances as required by flooring and adhesive manufacturers.
  5. Moisture condition and adhesive bond tests shall be performed as specified herein.
- B. For applications on concrete:



1. Verify concrete substrate has been cured and is sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture test
2. Verify curing, hardening, or breaking compounds have not been used. If there are any, do not proceed until compounds have been removed as specified.
3. For applications on concrete slab on grade or below grade, verify vapor barrier below slab was installed. If no vapor barrier was installed, do not proceed with work unless written acceptance of such conditions is received and submitted.
4. Perform testing of in situ concrete, relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings as specified herein. Do not proceed with work until results of moisture condition tests are acceptable.

### 3.2 SURFACE PREPARATION FOR TESTING

- A. General: Substrates shall be dry and clean. Remove all dirt, debris, sealers, coatings, finishes, film-forming curing compounds, and other substances which may affect the rate of moisture dissipation. Remove all dust by vacuum or other methods. Do not use chemicals of any kind to clean concrete.
  1. Non- chemical methods for removal, such as abrasive grinding or bead-blasting, including methods described in ASTM D 4259 may be used on existing slabs with deleterious residues to achieve an appropriate state for testing.
- B. To test for pH at the surface of a concrete slab, use care not to over abrade the surface of the concrete which can result in overstated pH readings.

### 3.3 TESTING IN SITU CONCRETE SUBSTRATES

- A. Scope:
  1. Provide in situ concrete relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings. Includes concrete placed as part of this Work which occurs below grade, above grade (suspended slabs), and slabs on grade.
    - a. Existing building suspended slabs may be excluded from this requirement.
- B. Scheduling:
  1. Testing shall take place after allowing concrete to dry for a minimum of 90 days. Testing to be scheduled no less than one, nor more than three weeks prior to scheduled flooring installation.
    - a. DO NOT conduct testing unless the slab environment is identical to that in which the finished flooring is to be installed.
- C. Test result submittals:
  1. Report all test results in chart form listing test dates, time, depth of test well, in situ temperature, relative humidity, moisture vapor and pH levels.
  2. List test locations on chart and show same on marked up Floor Plan Drawings.

3. Submit results in duplicate. Deliver copies directly to Architect, Owner's Project Representative and Construction Manager.
- D. Testing Procedures, quantification of Relative Humidity
1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F), and 50 percent (plus or minus 10 percent) relative humidity. When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with the test report.
  2. The number of in situ relative humidity test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
  3. Drill test holes utilizing a roto hammer drill. Hole diameter shall not exceed outside diameter of the insertable test sleeve by more than 0.04 inch (1mm). Drilling operation must be dry. Do not use water for cooling or lubrication; do not wet-core test hole. Determine the thickness of the concrete slab from Construction Documents. Depths of test holes shall be as follows:
    - a. For elevated slabs (not poured in pans): Drill test holes to a depth equal to 20 percent of the concrete thickness.
    - b. For slabs on grade and elevated slabs in pans: Drill test holes to a depth equal to 40 percent of the concrete thickness.
  4. Vacuum all concrete dust from test hole.
  5. Insert a hole liner, or sleeve, to the full depth of test hole, assuring that the liner is capped or plugged at the end protruding from the concrete surface.
  6. Permit the test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
  7. Remove the sleeve plug and place a probe into the sleeve assuring that it reaches the bottom of the test hole.
  8. Allow the probe to sit in the test sleeve for 30 minutes before taking readings.
  9. Read and record temperature and relative humidity at the test site.
- E. Testing Procedures, quantification of concrete moisture vapor emission through Calcium Chloride Testing:
1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F) and 50 percent relative humidity (plus or minus 10 percent). When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with the test report.
  2. The number of vapor emission test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.

3. Tests sites are to be cleaned of all adhesive residue, curing compounds, paints, sealers, floor coverings, and similar materials. 24 hours prior to the placement of test kits.
  4. Weigh test dish on site prior to start of test. Scale must report weight to 0.1 grams. Record weight and start time.
  5. Expose Calcium Chloride and set dish on concrete surface.
  6. Install test containment dome and allow test to proceed for 60 to 72 hours.
  7. Retrieve test dish by carefully cutting through containment dome. Close and reseal test dish.
  8. Weigh test dish on site recording weight and stop time.
  9. Calculate and report results as pounds of emission per 1,000 square feet per 24 hours."
- F. Testing Procedures, quantification of Acidity/Alkalinity (pH) Level:
1. At or near the relative humidity test site and each vapor emission (calcium chloride) test site, perform pH test.
    - a. At each testing site, lay down a loose 2 foot by 2 foot sheet of non perforated sheet backed by plywood. Leave in place for 48 hours.
    - b. Remove sheet and place several drops of distilled or de ionized water onto the concrete surface to form a puddle approximately 1 inches in diameter.
    - c. Allow the water to set for approximately 60 seconds.
    - d. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading
  2. Record and report results.
- G. Testing Procedures:
1. Initial testing: Provide 3 tests for the first 1,000 square feet.
  2. Add one test for each additional 1,000 square feet.
  3. Concrete surface area to be tested shall be completely clean as specified herein under Preparation.
  4. Perform moisture tests in strict accordance with the kit manufacturer's Instructions. Moisture tests shall remain undisturbed for 60 to 72 hours.
  5. Immediately after moisture test has been removed from test area, conduct pH test in area previously covered by plastic dome of moisture test kit.
  6. After completion of tests submit 2 copies of test data to the Architect. Submit a copy of the test data to all installers of flooring materials and resinous flooring materials scheduled to be installed.
  7. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.

### 3.4 FLOORING PREPARATION – GENERAL REQUIREMENTS

- A. Close spaces to pedestrian and worker traffic during the installation of the flooring.
- B. General: Comply with ASTM F 710 and manufacturer's recommendations for surface preparation. Remove substances incompatible with resilient flooring adhesive by method acceptable to manufacturer.
  - 1. Fill voids, cracks, and depressions with trowel-applied leveling compounds acceptable to manufacturer. Remove projections and repair other defects to tolerances acceptable to manufacturer.
  - 2. Remove, by light sanding and grinding, all protruding edges, high spots.
  - 3. Ensure substrate is flat to a plus or minus 1/8 inch in 10 feet tolerance. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
  - 4. Ensure that substrate is free from paint, varnish, wax, oil, or other foreign matter.
  - 5. For concrete substrates:
    - a. Concrete floors with steel troweled (slick) finish shall be properly roughened up (sanded) to ensure suitable adhesion.
    - b. Concrete floors with curing, hardening, and breaking compounds shall be abraded with mechanical methods only to remove compounds. Use blastrac or similar equipment.
- C. Protection of In-situ Conditions: During the operation of flooring work, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all surfaces which are soiled or otherwise damaged by Work, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.
- D. Use HEPA Vacuum to clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring. Perform vacuuming immediately prior to installation.
- E. Apply primers as recommended by adhesive manufacturer's written instructions.
- F. Condition flooring materials, accessories and adhesives to room temperatures for a period of 48 hours minimum, and as additionally required under individual Specification Sections.

### 3.5 PREPARATION FOR SELF-LEVELING UNDERLAYMENT

- A. Prepare existing concrete with steel brush cleaning, remove all loose and chipped existing concrete and applying bonding agent (primer) in accordance with manufacturer's instructions.
  - 1. Surfaces to receive underlayment shall be free of sealers, dirt, oil, grease, or other contaminants.
  - 2. Unless substrate or other surface preparation method is approved by manufacturer, surface shall be shotblasted prior to application of bonding agent (primer).

- B. Control Joints: Install control joints at junctures with vertical surfaces, including curbs, walls, and vents, for full depth of underlayment.

### 3.6 APPLICATION OF UNDERLAYMENT

- A. Place concrete underlayment in accordance with manufacturer's instructions, using equipment and procedures to avoid segregation of mix and loss of air content. Deposit and screed in a continuous operation until an entire section is completed, apply as continuously as possible following recommendations of manufacturer.
  - 1. Finish surface shall be smooth and level to within a tolerance of 1/8 inch when measured with a 10 foot straight edge.
  - 2. Leave top surface in acceptable condition to receive subsequent finishes.
- B. Air cure in accordance with manufacturer's instructions.

### 3.7 FLOORING INSTALLATION GENERAL

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
  - 1. Apply primers as recommended by adhesive manufacturer's written instructions.

### 3.8 ADHESIVE BOND TESTING

- A. Use the specified flooring and recommended adhesive, install approximately 36 by 36 inch sized flooring as specified under individual flooring specification sections. Install test samples approximately 50 feet apart throughout the area, but not less than 1 test per 1000 square feet. Areas next to walls or other light traffic areas should be selected for the bond test. Tape down the perimeter of the flooring to prevent drying of the adhesive at the edges. After a minimum period of 72 hours the flooring should be pulled from the subfloor. If an unusual amount of force is required, the bond could be considered sufficient. Floors demonstrating unsuitable bond to substrate require modifications to flooring installation and may require application of moisture mitigation products. Review all conditions with Architect/Engineer.

### 3.9 PROTECTION

- A. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Cover all floor surfaces with heavyweight kraft paper and overlay with red-rosin paper, taping the edges to maintain position of the protection paper. Reapply papers as required to maintain floor protection.

End of Section

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Section 09 21 17  
SHAFT WALL ASSEMBLIES

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install shaft wall systems including framing, liner and board finish components.
  - 1. Gypsum Board taping and finishing are specified under Section 09 29 00 – GYPSUM BOARD.
- B. Install access panels occurring in shaft walls, furnished by Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing finishes, partitions and walls as indicated in the Drawings.
- D. Section 06 10 00 - ROUGH CARPENTRY:
  - 1. Supplemental wood blocking.
  - 2. Installation of metal door frames in shaft wall systems.
- E. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
- F. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Non-load bearing partition and ceiling framing and furring.
- G. Section 09 29 00 - GYPSUM BOARD: Gypsum board finishes, applied over work of this Section 09 22 17, including: joint treatment, joint compound finishing and related trim components.
- H. Section 09 81 00 – ACOUSTICAL INSULATION: Acoustical batt insulation.
- I. Section 09 91 00 - PAINTING: Applied finish coatings.

#### 1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. ASTM C 475 - Joint Treatment Materials for Gypsum Wallboard Construction.
  2. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
  3. ASTM C 919 - Use of Sealants in Acoustical Applications.
  4. ASTM C 1047 - Accessories for Gypsum wall board and veneer base.
  5. ASTM C 1396 - Gypsum Wallboard.
  6. ASTM E 90 - Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
  7. ASTM E 119 - Fire Tests of Building Construction and Materials.
  8. GA 201 - Gypsum Board for Walls and Ceilings.
  9. GA 214 - Recommended Specifications for Levels of Gypsum Board Finish, Glass Mat and Fiber-Reinforced Gypsum Panels.
  10. GA 216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
  11. All applicable federal, state and municipal codes, laws and regulations for fire rated assemblies.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
  2. Work of this Section shall be closely coordinated with the work of Section 09 26 13 - GYPSUM VENEER PLASTERING, to assure the steady progress of the Contract.
  3. Work of this Section shall be closely coordinated with the work of Section 09 29 00 - GYPSUM BOARD, to assure the steady progress of the Contract.
- B. Sequencing: Do not install shaft wall until all pipes, ducts, conduits, and other such items which are to be enclosed thereby, have been permanently installed, inspected and approved.

#### 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
  2. Shop Drawings:
    - a. Details of any special conditions associated with fireproofing.

- b. Mark-up a set of blackline interior elevations indicate corrections to grid layout and provide dimensioning showing locations of all proposed control joints and expansion joints.
  - 1) Provide interior elevation drawings for interior elevations which are not included as part of the Contract Drawing set.
- 3. LEED Submittal Requirements:
  - a. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
    - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
      - a) Itemized vendor invoices for FSC-certified products.
      - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
    - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
  - b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
    - 1) Recycled Content:
      - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
      - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
    - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
      - a) Documentation should be in the form of one of the following:
      - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
      - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
      - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
      - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
      - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
    - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.



- c. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  - 2. Deliver materials in original packages, containers or bundles bearing brand name, identification of manufacturer or supplier.
- B. Storage and Handling Requirements:

1. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
    - a. Neatly stack board materials flat to prevent sagging.
  2. Handle board materials so to prevent damage to edges, ends and surfaces.
  3. Protect metal trim accessories and corner beads from being bent or damaged.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including plaster materials in packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.
- 1.8 SITE CONDITIONS
- A. In accordance with GA 216, maintain minimum ambient temperature of 50 degrees Fahrenheit 48 hours before, during taping and compounding, and until completely dry thereafter.
  - B. Environmental Conditions: Maintain minimum ambient temperature of 55 degrees Fahrenheit 48 hours before, during plastering, and until completely dry thereafter, but not less than 12 hours.

## **PART 2 - PRODUCTS**

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  1. Metal components and related items:
    - a. Clarkwestern Dietrich Building Systems, LLC, Schiller Park, IL.
    - b. Marino\Ware, Division of Ware Industries, South Plainfield, NJ.
    - c. Cemco Steel Framing and Metal Lath, City of Industry, CA.
    - d. Telling Industries, Mentor, OH.
    - e. United States Gypsum Company (USG), Chicago, IL.
  2. Gypsum liner panels and board materials:
    - a. United States Gypsum Company (USG), Chicago, IL.
    - b. National Gypsum Company, Charlotte, NC.
    - c. Georgia-Pacific Gypsum, LLC, Atlanta, GA.
    - d. Continental Building Products, Hendron, VA.
  3. Deflection track components and related items:
    - a. Cemco Steel Framing and Metal Lath, City of Industry, CA.
    - b. Clarkwestern Dietrich Building Systems, LLC, Schiller Park, IL.
    - c. Delta Star, San Carlos, CA.
    - d. Marino\Ware, Division of Ware Industries, South Plainfield, NJ.
    - e. Metal-Lite Inc., Crossville, TN

- f. Telling Industries, Mentor, OH.
  - g. The Steel Network, Inc., Durham, NC.
- B. The design and details as shown on the drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

## 2.2 DESCRIPTION

- A. Regulatory Requirements:
- 1. Fire resistance ratings: Provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters
  - 2. Seismic Compliance: Nonstructural components that are permanently attached to structures and their support attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance to local jurisdiction.
  - 3. Gypsum Board Recycled Content: Minimum 10 percent post-consumer recycled content, or minimum 40 percent pre-consumer recycled content at contractor's option.

## 2.3 MATERIALS

- A. Studs for shaft wall assemblies: 20 gage (0.0329 inch [0.84 mm] minimum thickness), galvanized and complying with ASTM C 645, 2-1/2 inch size, or as indicated otherwise in the drawings.
- 1. Framing members shall have a G-40 (hot-dipped galvanized) minimum protective coating conforming to ASTM A653 and ASTM A1003 (table 1). Equivalent coatings (G40e) will not be considered equal.
  - 2. Acceptable products include the following, or approved equal:
    - a. Clarkwestern Dietrich Building Systems, LLC, West Chester, OH, product, "C-T Stud".
    - b. Marino\Ware, Division of Ware Industries, South Plainfield, NJ, product: "CT-Stud".
    - c. Cemco Steel Framing and Metal Lath, City of Industry, CA, product; "C-H Studs".
    - d. Telling Industries, Mentor, OH, product; "C-T Stud".
    - e. United States Gypsum Company (USG), Chicago, IL, product, "C-H Studs".
- B. Runners for studs in shaft wall assemblies: J-track, galvanized and complying with ASTM C 645, with 2-1/4 inch leg, in size, gage and manufacturer to match shaft wall studs.
- C. Struts for jamb framing of door openings in shaft wall assemblies: J-type strut, galvanized and complying with ASTM C 645, 20 gage (0.0329 inch [0.84 mm] minimum thickness), with minimum 3 inch return.

- D. Shaftwall liner: UL fire resistance rated, ASTM C 442 - Type X board with beveled edges, 1 inch thick, 24 inches wide, of lengths to minimize end joints.
  - 1. Acceptable products include the following, or approved equal:
    - a. United States Gypsum Company (USG) Sheetrock Brand product; "Mold-Tough Liner Panels".
    - b. National Gypsum Company, Gold Bond Brand product; "Fire-Shield Shaftliner XP, with Sporgard".
    - c. Georgia-Pacific Gypsum, LLC, product; "DensGlass Shaftliner".
    - d. Continental Building Products, product; "Mold Defense Shaftliner Type X".
- E. Gypsum board types: Specified under Section 09 29 00 – GYPSUM BOARD.
- F. Gypsum board, "Paper-less" moisture and mold resistant board: 5/8 inch thick Glass mat, water-resistant, mold-resistant interior wall panel: Coated inorganic glass mat-faced, with Type "X" water-resistant, treated core gypsum wallboard. Physical properties conforming to the applicable sections of ASTM C 1177 and ASTM D3273.
  - 1. Acceptable products include the following or approved equal:
    - a. USG Sheetrock brand product "Mold-Tough Firecode X".
    - b. National Gypsum Company, Gold Bond brand product "EXP Interior Extreme Gypsum Panel."
    - c. Georgia-Pacific Gypsum, LLC, product, "DensArmor Plus Paperless Interior Panel.
    - d. Continental Building Products, product "Weather Defense Platinum Interior, Type X".

## 2.4 ACCESSORIES

- A. Finishing trim, joint tapes, compound and accessories: Specified under Section 09 29 00 – GYPSUM BOARD.
- B. Fasteners:
  - 1. Shaft wall framing:
    - a. Expansion-type fasteners for securing vertical concrete and masonry surfaces.
    - b. Concrete stub nails for securing runners to concrete.
    - c. N<sup>o</sup>.7 by 7/16 inch Pan head self-drilling screw to attach metal framing components.
  - 2. Board fasteners: In compliance with ASTM C954 or ASTM C1002, of head type, thread, point and finish as recommended by the shaft wall system manufacturer.
- C. Joint Sealers (Acoustical Sealant): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable. Acceptable products include the following, or approved equal.
  - 1. Tremco, Beachwood, OH. product, "Acoustical Sealant".

2. United States Gypsum Company, Chicago, IL. product, "USG Acoustical Sealant".
3. Pecora Corporation, Harleysville PA, product, "AC-20 FTR".

## 2.5 SOURCE QUALITY CONTROL

- A. Obtain shaft wall products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of shaft wall system.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that all items which are to be enclosed by Work of this Section, have been permanently installed, inspected and approved.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

### 3.2 INSTALLATION - GENERAL

- A. Erect shaft wall systems in strict accordance with the manufacturers' UL listed test construction for the required fire rating and in strict accordance with manufacturer's instructions, ASTM C 754 for Metal Framing, together with the additional requirements specified herein and as indicated on the Drawings.
- B. Install supplementary framing in shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
  1. Where handrails directly attach to shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 face-layer panel.
  2. Integrate stair hanger rods with shaft-wall assemblies by locating cavity of assemblies where required to enclose rods.

### 3.3 INSTALLATION OF SHAFT WALL

- A. Install J runners or E studs at floor and ceiling structural elements with suitable fasteners located 2 inches from each end and intermediate fasteners spaced no greater than 24 inches.
  1. Install runners and studs prior to fireproofing.
  2. Do not splice studs, all studs shall extend from the floor to the underside of the structure above in one single length.
- B. Install studs in direct contact with all door and window frame jambs, abutting partitions, partition corners and existing construction elements; screw fasten with one screw per flange.
  1. Where studs are installed directly to exterior masonry walls, install 15 pound asphalt felt between stud and wall.

- C. Install studs 3/8 inch to not more than 1/2 inch less than opening height and install between liner panels with liner inserted in the groove. Install full-length steel “E” studs over shaft wall liner at T-intersections, corners, columns and both sides of closure panels. Frame openings cut within a liner panel with “E” studs around perimeter. For openings, frame with vertical “E” studs at edges, horizontal J-strut at head and sill, and reinforcing as recommended by the shaft wall manufacturer. Suitably frame all openings to maintain structural support for wall.
- D. Furnish and install additional cross bracing and other framing elements, as required to assure a completely rigid assembly on metal stud partitions and furred areas, whether or not such bracing has been indicated on the Drawings, and for proper receipt of items which will be attached to partition surfaces.
  - 1. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices and similar items.
- E. Cut liner board panels 1 inch less than opening height and erect vertically between J-runners. Where shaft walls exceed 14 feet in height, position liner panel end joints within upper and lower third points of wall. Stagger joints top and bottom in adjacent panels.
  - 1. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.
- F. Erect fire rated gypsum panel base layer horizontally on one side of studs with end joints staggered. Fasten base layer to studs with 1 inch, Type S-12 screws. Caulk perimeter of base layer panels.
- G. Apply fire rated gypsum panels face layer vertically over base layer with joints staggered and attach with 1-5/8 inch Type S-12 screws staggered from those in base, spaced 12 inches on center and driven into studs.
- H. Finish boards, trim and joint compound finishing as specified under Section 09 29 00 – GYPSUM BOARD.

#### 3.4 APPLICATION OF ACOUSTICAL SEALANT

- A. General: Install sealant and backing in accordance with the recommendations of ASTM C-919 and sealant manufacturer’s recommendations.
  - 1. Perform preparation in accordance with C-790. Thoroughly clean all joints, removing all loose mortar, oil, grease, dust, frost, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
  - 2. If so recommended and furnished by the specific sealant manufacturer, apply primer to all joint surfaces, taking care not to stain adjacent surfaces.
- B. Seal all partition perimeters prior to taping or compounding. Where perimeters are edged with metal trim, apply sealant and backing material between trim and dissimilar material.
- C. Seal all penetrations in partition types designated for “acoustical” insulation. Penetrations to receive sealant include electrical boxes, plumbing, heating and air conditioning ducts, telephone, intercom hookups and similar items.

1. Install joint bead back-up in all joints in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.
  - a. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
  - b. Do not stretch back-up material into joints.
  - c. Install bond breaker wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.
2. Apply sealant in continuous beads without open joints, voids or air pockets
  - a. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
3. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

### 3.5 APPLICATION OF JOINT TREATMENT

- A. Application of joint tape and compound finishing is specified under Section 09 29 00 – GYPSUM BOARD.

### 3.6 TOLERANCES

- A. Install shaft wall partitions with a maximum variation from true flatness of 1/8 inch per 10 feet, noncumulative.

### 3.7 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris, scraps, and deposits of compound and gypsum fill.
- B. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of gypsum fill, and other materials installed under this Section.

End of Section

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Section 09 22 16

NON-STRUCTURAL METAL FRAMING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
  - 1. Metal furring and framing where indicated on the Drawings, including cross bracing and knee bracing.
  - 2. Metal ceiling and soffit framing.
  - 3. Metal ceiling and soffit framing, including hanger attachments, wire hangers, and screwable metal tee grid system.
  - 4. Reinforcing plate blocking.
  - 5. Deflection track assemblies at tops of metal stud partitions.
    - a. Provide fire-rated assemblies at fire-rated, corridor, and smoke partitions.
    - b. Provide non fire-rated assemblies at all other partitions.

1.3 RELATED REQUIREMENTS

- A. Section 01 73 29 - CUTTING AND PATCHING: Procedural and administrative requirements for cutting and patching.
- B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- C. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- D. Section 05 40 00 - COLD-FORMED METAL FRAMING: Load bearing framing.
- E. Section 06 10 00 - ROUGH CARPENTRY:
  - 1. Wood blocking and framing, where indicated.
  - 2. Installation of metal door frames in gypsum board work.
  - 3. Installation of metal door frames in veneer plaster work.
- F. Section 07 21 00 - THERMAL INSULATION.
- G. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing steel door frames.



- H. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in partitions and walls.
- I. Section 09 01 23 - PLASTER PATCHING AND REPAIR.
- J. Section 09 21 17 – SHAFT WALL ASSEMBLIES: Framing supporting shaft wall assemblies, and fire-resistant liner panels.
- K. Section 09 29 00 - GYPSUM BOARD: Gypsum board, applied over metal framing installed by this Section 09 22 16 including: gypsum board, and related trim components.
- L. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceiling, including related metal suspension system.
- M. Section 09 81 00 – ACOUSTICAL INSULATION: acoustical batt insulation between framing.
- N. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Supply and return air registers.
- O. Division 26 - ELECTRICAL: Independent hangers for suspended lighting fixtures.

#### 1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
  1. ASTM C 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process..
  2. ASTM C 645 - Non-Load Bearing Steel Studs, Runners, and Rigid Furring Channels for Screw Application of Gypsum Board.
  3. ASTM C 646 - Steel Drill Screws for the Application of Gypsum Sheet Material to Light Gage Steel Studs.
  4. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard.
  5. ASTM E 90 - Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
  6. ASTM E 119 - Fire Tests of Building Construction and Materials.
  7. GA 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum board.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work
2. Work of this Section shall be closely coordinated with the work of Section 09 29 00 - GYPSUM BOARD to assure the steady progress of the Contract.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
  2. LEED Submittal Requirements:
    - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
      - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
        - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
        - b) EPD shall have at least Cradle to Gate scope,
      - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
    - b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
      - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
        - a) Itemized vendor invoices for FSC-certified products.
        - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
      - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
    - c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
      - 1) Recycled Content:
        - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
        - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
      - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
        - a) Documentation should be in the form of one of the following:

- 
- b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
  - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
  - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
  - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
  - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
- 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area

- 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
- 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.

#### 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Seismic Compliance: Nonstructural components that are permanently attached to structures and their support attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance to local jurisdiction.
- C. Sole Source: Obtain products required for the Work of this Section from a single manufacturer.
- D. Qualifications:
  1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Storage and Handling Requirements:
  1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  2. Protect materials from damage due to moisture, surface contamination, corrosion and damage from construction operations and other causes.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  1. Metal components and related items (including non-rated deflection track assemblies):
    - a. ClarkDietrich Building Systems, LLC, West Chester, OH.
    - b. Marino\Ware, Division of Ware Industries, South Plainfield NJ.
    - c. Cemco Steel Framing and Metal Lath, City of Industry, CA.
    - d. Telling Industries, Willoughby, OH.
    - e. Super Stud Building Products, Inc., Edison NJ.
  2. Fire rated deflection track assemblies:
    - a. Cemco Steel Framing and Metal Lath, City of Industry, CA.

- b. ClarkDietrich Building Systems, LLC, West Chester, OH.
  - c. Fire Trak Inc., Watkins, MN.
  - d. Metal-Lite Inc., Crossville, TN
  - e. The Steel Network, Inc., Durham, NC.
3. Suspended furring system for ceilings and soffits:
- a. Armstrong World Industries, Inc., Lancaster, PA.
  - b. Chicago Metallic Corporation, Chicago IL.
  - c. USG Corporation, Chicago IL.
- B. The design and details as shown on the drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

## 2.2 DESCRIPTION

### A. Regulatory Requirements

- 1. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.
- 2. Fire resistance ratings: Where gypsum board systems with fire-resistance ratings are indicated, provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters.
  - a. Fire-Test-Response Characteristics: Provide components that comply with rating requirements specified for fire-rated assemblies under UL 2079 for non-load bearing wall systems.
    - 1) Deflection Clips and Firestop Track: Connections and/or top runner provided in fire-resistance-rated assemblies shall be certified by UL 2079 for cyclic movement requirements.

### B. Sustainability Requirements:

- 1. Recycled content of Steel: Use maximum available percentage of recycled steel. Steel framing products incorporated into the work shall contain not less than 30 percent of recycled steel.

## 2.3 FRAMING MATERIALS

- A. "Hat shaped" Furring channels: 7/8 x 2-3/4 inch, roll-formed, hat-shaped, furring channel 25 gage hot-dip galvanized steel conforming to ASTM C 645.
- B. Resilient (acoustical) furring channels:
- 1. Soundproof Cow, Chambersburg PA, product: "IsoTRAX."
  - 2. Green Glue Company, Granville, NY, product: "Whisperclips."
  - 3. Pliteq Inc., Vaughan Ontario Canada, product: "Genieclip RST."
  - 4. Kenetics Noise Control, Inc., Dublin OH, product: "IsoMax."

- C. Furring channels: 'Z-shaped' 1-1/2 inch depth, roll-formed, 25 gage (0.179 inch [0.45 mm] minimum thickness), hot-dip galvanized steel.
- D. Studs: 'C-shaped' screw studs, hot-dip galvanized steel complying to ASTM C 645, 20 gage-equivalent (nominal 0.02 inches [0.75 mm] factory ribbed and/or embossed for performance equivalent to 20 gage (0.0329 inch [0.84 mm] minimum thickness studs), of widths indicated on the Drawings.
  - 1. Framing members shall have a G-40 (hot-dipped galvanized) minimum protective coating conforming to ASTM A653 and ASTM A1003 (Table 1), or approved "G40EQ" equivalent coating.
  - 2. Acceptable products include the following or approved equal:
    - a. ClarkDietrich Building Systems, LLC, product "ProStud20" series.
    - b. Marino\Ware, Division of Ware Industries, product: "ViperStud Viper20".
    - c. Cemco Steel Framing and Metal Lath, product; "ViperStud Viper20".
    - d. Telling Industries, product; "ViperStud".
    - e. Super Stud Building Products Inc., product: "Edge EQ, EDS20P".
  - 3. Provide full 20 gage (0.0329 inch [0.84 mm] minimum thickness studs where required under the indicated UL assemblies to meet fire resistance ratings.
- E. Runners for metal studs: 'U-shaped' hemmed, hot-dip galvanized steel track conforming to ASTM C645, of gage and width to match respective stud sizes, or heavier gage per design requirements, having 1-1/4 inch leg, provided at tops and bottoms of all studs and at heads of all openings in stud partitions.
- F. Internal reinforcement for various stud conditions, and bracing as required: 10 gage, minimum, galvanized steel.
- G. Furnish cross bracing and knee bracing, as required to assure a completely rigid assembly on metal stud partitions and furred areas.

## 2.4 DEFLECTION TRACK ASSEMBLIES

- A. Non Fire-Rated Assemblies
  - 1. Deflection Track: Manufacturer's standard top runner with extended flanges designed to prevent cracking of gypsum board applied to interior partitions resulting from deflection of the structure above fabricated from steel sheet complying with ASTM A 653 or ASTM A 568. Thickness as indicated for studs, and width to accommodate depth of studs, and the following configuration.
    - a. Top runner with extended deep flanges that have one of the following: V-shaped offsets that compress, slots 1 inch on center that allow fasteners for stud attachment; 16 gage sliding clip assemblies attached to top track and clipped to stud, or double track systems as required to meet anticipated vertical movement.
  - 2. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    - a. Cemco Steel Framing and Metal Lath, product; "Slotted Track CST".

- b. ClarkDietrich Building Systems, LLC, product; "Deep Leg Deflection Track System", "Fast Top Clip", or "DoubleTrack System".
  - c. MarinoWare, Division of Ware Industries, product: "Slotted Track".
  - d. Metal-Lite, Inc., product: "Slotted Track".
  - e. Super Stud Building Products Inc., product: "ITTC 450 Top Track Deflection Clip".
  - f. Telling Industries, product; "ViperTrack Deep Leg Deflection Track".
  - g. The Steel Network, Inc., product; "VertiTrack VT", "VertiTrack VTD", or "VertiClip SLD".
- B. Fire-Rated Assemblies: Head of wall dynamic fire rated joint systems for assemblies in compliance with UL 2079 HW-D. Provide clips or deep leg track system including step bushings complying with ASTM C 645 fabricated from steel sheet complying with ASTM A 653 or ASTM A 568. Thickness as indicated for studs, and width to accommodate depth of studs.
- 1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    - a. Cemco Steel Framing and Metal Lath, product; "FAS Track UL Assemblies".
    - b. ClarkDietrich Building Systems, LLC, product; "SLP-TRK Slotted Deflection Track".
    - c. Fire Trak Inc., Watkins, MN, product "Fire Trak", or "Posi Clips"
    - d. Metal-Lite, Inc., product: "Fire Trak".
    - e. The Steel Network, Inc., Durham, NC. product; "VertiClip SLD".
- C. Coordination: Verify with partition schedule on the Drawings to ensure proper depth of flange offsets at various partitions types.

## 2.5 CEILING AND SOFFIT SUSPENSION MATERIALS

- A. Hanger attachments: Galvanized steel hanger eyes, of size and capacity to safely sustain a live load of at least 150 pounds per hanger attachment.
- B. Hangers: Soft temper, pre-stretched galvanized carbon steel wire, conforming with ASTM A641, with a yield stress load of at least three times design load, but not less than 12 gage.
- C. Sound isolation hangers: precompressed rubber isolation hanger; designed for up to 200 pounds per hanger load capacity.. Size and space hangers as recommended by manufacturer for anticipated ceiling load.
  - 1. LD Peters & Sons, Inc., New Rochelle NY, type ARH-1
  - 2. Mason Industries, Inc., Happaugue NY, WHR series
  - 3. Kinetics, Inc., type AF series.
- D. Grid system for direct attachment of finish board: Comprised of double web main furring tees, 1 1/2 inches high by 1-3/8 inches flange face by 0.020 inch thick; double web cross tees, 1 1/2 inches high by 15/16 inch flange face by 0.020 inch thick; 0.020 inch thick wall channels, with 1 1/2 inches interior web height; and all

splices, clips, and related items. Provide Underwriters Laboratories Label fire-rated assemblies for locations requiring fire-rated ceilings and soffits

1. Chicago Metallic product "system 640 Furring System".
2. Armstrong Word Industries product "Drywall Furring System".
3. Donn (USG) Corporation, Chicago IL., product "USG Drywall Furring System" with DGLW tees.

## 2.6 CEILING AND SOFFIT FRAMING MATERIALS

- A. Carrying channels, 2 inches deep, 16 gage cold-rolled channels, galvanized.
- B. Support channels: 3/4 inches deep, 16 gage cold-rolled channels, galvanized.
- C. Furring Channels: 7/8 x 2-3/4 inch, roll-formed, hat-shaped, furring channel 25 gage hot-dip galvanized steel conforming to ASTM C 645.
- D. Metal Studs used in soffit and ceiling framing: 'C-shaped' screw studs, hot-dip galvanized steel complying to ASTM C 645, 25 gage, of widths indicated on the Drawings, or other gages as required under the specified standards to meet fire resistance ratings.

## 2.7 ACCESSORIES

- A. Metal sheet plate blocking and bracing, where indicated: galvanized sheet 0.0312 inch thickness (20 gage).
- B. Fasteners:
  1. Expansion-type fasteners for securing vertical concrete and masonry surfaces.
  2. Concrete stub nails for securing runners to concrete.
  3. N<sup>o</sup>.7 by 7/16 inch Pan head self-drilling screw to attach metal framing components.
- C. Asphalt felt moisture barrier: ASTM D226, No. 15 asphalt saturated roofing felt.
- D. Reinforcing plates for blocking: 20 gage cold rolled sheet steel, provide minimum 6 inch width, or as otherwise indicated on the drawings.
- E. Sound Isolation Clips: 3 inch wide acoustical clip fabricated from 16 gauge galvanized or aluminum-zinc steel manufactured by PAC International, Inc., Las Vegas, NV, product: Resilient Sound Isolation Clip (RSIC-1).
  1. Rubber Isolator:
    - a. Natural organic rubber compound, blended with fire-inhibiting compounds molded to isolate ferrule from clip with a minimum of 12 micro-vibration controlling pedestals at point of contact with framing member.
    - b. Sound isolation clips shall comply with ASTM D 2000 and the following characteristics:
      - 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.
  2. Ferrule: Zinc-electroplated steel.
  3. Projection: 1-5/8 inches from supporting structure with 7/8-inch drywall furring channels.
- F. Acoustical partition isolation pads: Isolation pad fabricated from pre-compressed fiberglass 1/2" thickness and designed to carry continuous loads of 25 psi without excessive creep or pad failure. Pad deflection shall be less than 0.175 inches (4.45 mm) at maximum rated load. Pads shall have sufficient compressive strength to sustain continuously applied partition weight without settling and be equal to Kinetics Noise Control, product "Wallmat". Anchor isolation bushing for top and bottom runners shall be a minimum of 1/2" inch total thickness, 60 durometer element preventing any rigid contact of the anchor to either runner of the steel studwall. Runners shall be anchored to the floor/ceiling using isolation bushings equal to Kinetics Noise Control Model "KAI" rubber isolation step bushings spaced at 16" (40.6 cm) on center.

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION, QUALITY STANDARDS**

- A. General: Perform erection procedures for the various gypsum board system conditions, except as otherwise specified, as set forth in GA 201, GA 206, the written instructions of gypsum board manufacturer, together with the additional requirements specified herein and as indicated on the Drawings.
- B. Wherever fire-resistive rated assemblies are indicated on the Drawings, erect gypsum board systems in strict accordance with the manufacturers' UL listed test constructions for the required fire rating on each specific assembly.

#### **3.2 INSTALLATION OF FURRING**

- A. Install metal furring channel horizontally, with channels spaced not more than 16-inch on centers, and attaching the channels to the masonry or concrete substrates with expansion type fasteners spaced not more than 8 inches on centers. Shim beneath channels as needed to ensure that a uniform receiving plane is maintained throughout.

#### **3.3 INSTALLATION OF PARTITION FRAMING, GENERAL**

- A. Install metal runners at floor and ceiling to structural elements with suitable fasteners located 2 inches from each end and intermediate fasteners spaced no greater than 24 inches.
- B. Install metal stud framing with open side facing in same direction, engaging floor and ceiling runners.
  1. Stud spacing:
    - a. Typical: 16 inches on-center.
    - b. For abuse-resistant gypsum board finish: 16 inches on-center.
    - c. For cement board substrate to receive tile finishes: 16 inches on-center.
    - d. For partitions supporting wall cabinets and other wall mounted equipment: 12 inches on-center.

- e. For curved partitions space framing closer together than normal to prevent flat areas between framing members.
  - 2. When necessary to splice studs, nest stud with 8 inch overlap and screw studs together with screws on both flanges.
  - 3. Where studs are installed directly to exterior masonry walls, install asphalt felt between stud and wall.
- C. Install studs in direct contact with all door and window frame jambs, abutting partitions, partition corners and existing construction elements; screw fasten with screw through both flanges of studs and track, top and bottom.
- D. Securely anchor studs to jamb and head anchors of steel door and window frames. Over head of frames and openings in partitions, install a horizontal section of runner with a web flange bent at each end, horizontally and secure to strut studs with two screws in each bent web. Provide cripple studs over wall openings.
- E. Where horizontal studs are used for wall reinforcing or framing, cut pieces of stud and install horizontally between vertical studs. Cope horizontal studs to fit between flanges of vertical studs. Bend ends of horizontal studs or install clip angles in order to secure by screwing to vertical studs.
- F. Furnish and install additional cross bracing and knee bracing and other framing elements, as required to assure a completely rigid assembly on metal stud partitions and furred areas, whether or not such bracing has been indicated on the Drawings, and for proper receipt of items which will be attached to partition surfaces.
- 3.4 INSTALLATION OF DEFLECTION TRACK
- A. Isolate interior metal stud framing and shaft wall framing from building structure to prevent transfer of loading imposed by structural movement due to deflection.
- 1. Install deflection track top runner in accordance with manufacturer's instructions and as required to attain lateral support and avoid axial loading.
  - 2. Install fire-rated deflection track top runner in accordance with manufacturer's instructions at top of fire-rated, corridor and smoke partitions.
- 3.5 INSTALLATION OF ACOUSTICAL PARTITION ISOLATION PADS
- A. Isolation pads shall be installed in a continuous layer separating the stud wall runners from the non-isolated floor and/or ceiling deck as indicated on the Drawings. All resilient isolation materials shall be installed in accordance with procedures submitted by the manufacturer, and as approved by the Architect.
- 3.6 INSTALLATION OF REINFORCING PLATE BLOCKING
- A. Install steel reinforcing plates in partitions and furred walls for the support of wall mounted objects as follows:
- 1. Wherever such reinforcing plates are indicated on the drawings.
  - 2. In locations where wall bumpers are to be installed for the protection of wall surfaces from swinging doors. (See Section 08 71 00 - DOOR HARDWARE).

- B. Secure gage sheet metal reinforcing plates to steel studs with 1-1/4", Type "S" bugle head screws.

### 3.7 INSTALLATION - CEILING SUSPENSION SYSTEM

- A. Coordinate layout and installation of suspension system components for suspended ceilings with other work supported by, or penetrating work of this section. Re-adjust ceiling suspension system, prior to the installation of the gypsum board and after installation of mechanical and electrical equipment and fixtures by the respective trades.
- B. Install all components of concealed grid system in accordance with the manufacturer's instructions, with current ASTM C 636 requirements, with design and installation of suspended grid system safely sustaining a membrane loading of at least 7.9 pounds per square foot.
- C. Install hangers not more than 24 inches on centers over locations of main tee members. Install hanger wires to hanger attachment with triple twists. Install additional wires as required to provide support for main tees, at intervals not exceeding four feet, wherever main tees must be interrupted in order to install other work and at all other locations as may be directed by the Architect.
- D. Install main tees parallel to long dimension of the area, at spacing not to exceed 48 inches on-center. Secure with hanger wire as the work progresses. Install cross tees as recommended by the system manufacturer, except spacing shall not exceed 16 inches on-center.

### 3.8 INSTALLATION OF CEILING AND SOFFIT FRAMING

- A. Install framing to height indicated, independent of walls, columns, and above ceiling work. Erect after Work above ceiling is complete. Coordinate the location of hangers with other work.
- B. Securely anchor hangers to structural members or embed in structural slab. Space hangers to achieve deflection limits indicated.
- C. Space main carrying channels at maximum 48 inch centers; not more than 4 inches from wall surfaces. Lap splice securely.
- D. Securely fix furring channels or metal studs to hangers to prevent turning or twisting and to transmitted full load to hangers.
  - 1. Place furring channels perpendicular to carrying channels at 16 inches on center, not more 1 inch from perimeter walls and rigidly secure. Lap splice securely.
  - 2. Screw fasten metal studs perpendicular to carrying channels at 16 inches on center, not more 1 inch from perimeter walls. Lap splice securely.
- E. Reinforce openings in suspension system which interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

3.9 TOLERANCES

- A. Install partition and ceiling framing and furring with a maximum variation from true flatness of 1/8 inch per 10 feet, noncumulative.

End of Section

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Section 09 24 00  
PORTLAND CEMENT PLASTERING  
(STUCCO)

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Patch existing damaged, deteriorated and unsound portland cement plaster.
  - 1. Patching and repair work includes without limitation:
    - a. Patch existing portland cement plaster disturbed by new construction.
    - b. Patch all cracks in existing portland cement plastered surfaces which are to remain and which are indicated to be painted.
    - c. Removing unsound and loose existing stucco and replace. With three-coat portland cement plaster with steel trowel surface finish applied directly over masonry units.
  - 2. Repair methods: The exact repair procedures shall be reviewed in the field, based on the guidelines and materials specified herein. Review all procedures with the Architect and obtain acceptance prior to commencing the work. Repair methods selected shall take into account the total construction system of the existing building.
- B. Provide related metal lath, screeds, grounds and expansion/control joints, and trim accessories.

1.3 RELATED REQUIREMENTS

- A. Section 01 73 29 - CUTTING AND PATCHING: Procedural and administrative requirements for cutting and patching.
- B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- C. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- D. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing finishes, partitions and walls as indicated in the Drawings
- E. Section 06 10 00 - ROUGH CARPENTRY: Wood framing and blocking supporting plaster substrate.

- F. Section 07 21 00 - THERMAL INSULATION: Thermal and acoustical batt insulation.
- G. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing steel door frames.
- H. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
- I. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal studs, runners and furring channels, internal metal struts, bracing, and supplementary framing.
- J. Section 09 29 00 - GYPSUM BOARD: Gypsum board finish partitions, ceilings and soffits.
- K. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceiling.
- L. Section 09 91 00 - PAINTING: Applied Finish Coatings.
- M. Section 10 28 13 - TOILET ACCESSORIES: Furnishing installation templates for toilet accessories.
- N. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Supply, and return air registers.
- O. Division 26 - ELECTRICAL:
  - 1. Independent hangers for suspended lighting fixtures.
  - 2. Metal frames for recessed light fixtures.

#### 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. All applicable federal, state and municipal codes, laws and regulations for fire rated assemblies.
  - 2. ASTM C 91 - Masonry Cement.
  - 3. ASTM C 150 - Portland Cement.
  - 4. ASTM C 206 - Finish Hydrated Lime.
  - 5. ASTM C 207 - Hydrated Lime for Masonry Purposes.
  - 6. ASTM C 665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - 7. ASTM C 897 - Aggregate for Job-Mixed Portland Cement Based Plasters.
  - 8. ASTM C 926 - Application of Portland Cement Based Plaster.
  - 9. ASTM C 1063 - Installation of Lathing and Furring for Portland cement Based Plaster.
  - 10. ASTM D 1784 - Polyvinyl chloride material for outdoor exposure.
  - 11. ASTM E 119 - Methods for Fire Tests of Building Construction and Materials.
  - 12. PCA - Portland Cement Plaster (Stucco) Manual.

13. National Park Service, Preservation Brief 22 – The Preservation and Repair of Historic Stucco.

## 1.5 ADMINISTRATIVE REQUIREMENTS

### A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
2. To assure the steady progress of the Contract, closely coordinated the work of this Section with the following:
  - a. Section 04 92 00 - Stone Masonry Restoration.
3. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall.
4. Attach penetrations through stucco into structural support and provide water tight seal at penetrations.

### B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Owner or designated representative, Architect, General Contractor, Installer's/Applicator's Project Superintendent, Stucco manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work.
2. Agenda:
  - a. Scheduling of stucco operations.
  - b. Review of staging and material storage locations.
  - c. Coordination of work by other trades.
  - d. Installation procedures for ancillary equipment.
  - e. Protection of completed Work.
  - f. Establish weather and working temperature conditions to which Architect and Contractor must agree.
  - g. Emergency rain protection procedure.
  - h. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.

### C. Sequencing:

1. Field Measurements
  - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
  - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.



1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: product data sheets, physical properties and limitations for plaster materials.
  2. Verification Sample: Two samples 24 by 24 inch in size illustrating finish color and texture.

1.7 QUALITY ASSURANCE

- A. Stucco subcontractor: Work must be performed by a firm with not less than 10 years successful experience in comparable conservation plaster projects.
1. The subcontractor's workers shall skilled and experienced with the materials and requirements specified. The subcontractor shall maintain on site, full time a foreman/job superintendent having a minimum of 5 years documented successful experience in comparable plaster restoration projects of the type required for modifications and alternation of this project. Owner retains the right to review the foreman/job superintendent's qualifications and request for a more qualified person if the Owner deems necessary.
- B. Perform work in accordance with PCA Portland Cement Plaster (Stucco) Manual.
- C. Fasten lath to substrate as required by the California Building Standards Code.

1.8 REGULATORY REQUIREMENTS

- A. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.
- B. Fire resistance ratings: Where plaster partitions [wall,] [and ceiling systems] with fire-resistance ratings are indicated, provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters.

1.9 MOCK-UP

- A. Provide mockup of plaster patching with accessories under provisions of Section 01 43 39.
1. Provide stucco mock-up panels over masonry, mock-up shall be a minimum 25 square feet, illustrating color, texture and finish, and demonstrating the minimum standard for the Work and exact match with Architect's approved sample.
- B. Locate mock-ups where directed and include all surfaces and materials scheduled to receive a field applied finish.
- C. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.

- D. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

#### 1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
- C. Protect metal trim accessories, plaster screeds and corner beads from being bent or damaged.

#### 1.11 ENVIRONMENTAL CONDITIONS

- A. Do not apply plaster when substrate or ambient air temperature is less than 50 degrees Fahrenheit nor more than 80 degrees Fahrenheit.
- B. Maintain minimum ambient temperature of 50 degrees Fahrenheit during installation of plaster and until cured.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include, the following, or approved equal:
  - 1. Pre-mix Plaster:
    - a. Silpro Masonry Systems, Inc., Ayer MA.
    - b. Parex LaHabra Products, Inc., Redan, GA.
    - c. Merlex Stucco, Inc., Orange CA.
  - 2. Metal accessories and related items:
    - a. United States Gypsum Company, Chicago IL.
    - b. National Gypsum Company, Gold Bond Products Division, Charlotte NC.
    - c. Georgia Pacific Corporation, Gypsum Division, Atlanta GA.
  - 3. Polyvinyl chloride trim and accessories:
    - a. Plastic Components, Inc., Miami FL.
    - b. Trim-Tex Drywall Products, Lincolnwood IL.
    - c. Vinyl Corporation, Miami FL.
    - d. Alabama Metal Industries Corporation, (AMICO)Birmingham, AL.

#### 2.2 PLASTER BASE MATERIALS

- A. Coating reinforcement: Glass fiber mesh, woven treated for improved bond with coating. Sto Corporation product "Sto Armor Mat XX, (15 ounces per square yard).
- B. Premixed base coat:

- C. Lime: ASTM C 207, Type S.
- D. Aggregate: In accordance with PCA, Portland Cement Plaster (Stucco) Manual.
- E. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.
- F. Admixtures: Air entrainment.
- G. Plaster Mix reinforcement: Standard mesh weight 4.5 oz/yd<sup>2</sup> (153 g/m<sup>2</sup>) reinforcing mesh. Mandatory for all exterior stucco surfaces.

### 2.3 PLASTER FINISH MATERIALS

- A. Cement: As specified for plaster base coat, color to match in-situ plaster, or Architect's control sample, as appropriate to individual surface planes.
- B. Lime: As specified for plaster base coat.
- C. Color pigment: Conforming to ASTM C979, mineral oxide pigment, to match specified colors.
- D. Finish Aggregate: Blended 20-30 mesh size aggregate for float sand finish (fine to medium texture), matching existing.
- E. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.

### 2.4 ACCESSORIES

- A. 300 Series stainless steel accessories for portland cement plaster:
  - 1. Casings: 3/4 inch ground.
  - 2. Corner beads: Minimum 2 7/8 inch wide expanded flanges.
  - 3. Control and Expansion joints: M shape with expanded flanges, 3/4 inch ground.
- B. Diamond mesh lath: Expanded metal lath with (small diamond) 5/16 inch wide diamonds, prime painted, weighing 2.5 pounds per square yard and complying with ASTM C 847.
  - 1. Inside corner reinforcement: 4 inch wide strip of diamond mesh lath bent at the center to a 100 degree angle.
- C. Control and expansion joint accessories: Extruded solid zinc, minimum 26 gage; accordion profile, 2 inches thick, solid flanges each side.
- D. Fasteners:
  - 1. Expansion-type fasteners for securing vertical concrete and masonry surfaces.
  - 2. Concrete stub nails for securing runners to concrete
  - 3. Type S bugle head screws complying with ASTM C 646, 1 inch long for single layer gypsum board, 1-5/8 inches long for double-layer gypsum board, for

applying gypsum boards to metal or wood framing, ceiling grid system, and furring channels.

## 2.5 MIXES

- A. Mix cement plaster in accordance with PCA, Portland Cement Plaster (Stucco) Manual.
  - 1. Scratch coat: Proportion and mix cement plaster in accordance with ASTM C 926, Type C with the following proportions: One volume portland cement, up to 1/2 volume hydrated lime, and sand equal to 2-1/2 to 4 times the sum of cement and lime, and glass fibers in proportions recommended by manufacturer.
  - 2. Brown coat: Proportion and mix cement plaster in accordance with ASTM C 926, Type C with the following proportions: One volume portland cement, up to 1/2 volume hydrated lime, and sand equal to 3 to 5 times the sum of cement and lime, and glass fibers in proportions recommended by manufacturer.
- B. Finish coat: Premix in accordance with manufacturer's instructions.
- C. Mix only as much plaster as can be used prior to initial set.
- D. Add color pigments to finish coat in accordance with manufacturer's instructions. Ensure uniformity of mix and coloration.
- E. Mix materials dry, to uniform color and consistency, before adding water.
- F. Add air entrainment admixtures to all coats to provide 5 to 7 percent entrainment.
- G. Protect mixtures from freezing, frost, contamination, and evaporation.
- H. Do not retemper mixes after initial set has occurred.

## 2.6 CLEANING MATERIALS

- A. General: All chemical materials shall be safe in use and shall comply with city, state, or federal environmental and safety regulations. All effluents shall be contained, neutralized and disposed of as recommended by the manufacturer in compliance with federal, state and local authorities having jurisdiction.
- B. Water for Cleaning: Clean, potable, non-staining and free of oils, acids, alkalis, salts and organic matter.
- C. Cleaner and etching compound: Water-based, biodegradable, odorless, non-flammable, equal to:
  - 1. Supreme Chemicals of GA, Inc., product "Krud Kutter".
  - 2. Interstate Products Inc., "Orange Crystal Powder Degreaser Concentrate" and "Orange Plus Super Orange Plus Tar Remover".
- D. Liquid-Strippable Masking Agent: Manufacturer's standard product for protecting glass, metal and polished stone surfaces from effects of masonry cleaners: "Sure Klean Strippable Masking"; ProSoCo, Inc., Kansas City, KS, or equal as provided by cleaner manufacturer.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that all items which are to be enclosed by Work of this Section, have been permanently installed, inspected and approved.
- B. Verify substrate conditions are acceptable to receive stucco finish:
  - 1. Substrate materials and construction shall conform to the building code having jurisdiction
  - 2. Substrates shall be sound, dry and free of dust, dirt, laitance, efflorescence and other harmful contaminants.
  - 3. Substrate Dimensional Tolerances: Flat with  $\frac{1}{4}$  in (6.4 mm) within any 4 ft (1220 mm) radius.
  - 4. Maximum deflection of substrate system under positive or negative design loads shall not exceed L/360 of span.
  - 5. Verify masonry joints are cut flush and surface is ready to receive work of this Section. Verify no bituminous or water repellent coatings exist on masonry surfaces.
- C. Do not install air barrier, stucco, primers or finishes over efflorescence, laitance or weak surface conditions, painted, coated, salt-contaminated, non-absorbent, smooth, or any concrete or CMU substrate where adhesion is in question.
- D. Beginning of installation means acceptance of substrate and project conditions.

#### 3.2 PREPARATION

- A. Protection of existing surfaces: Exercise reasonable care and precautions during the operation of work of this Section to protect existing non-masonry finishes against damage. Repair all existing materials which are damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be repaired shall be removed and replaced with new work to match existing at no additional cost to the Owner.
  - 1. Provide protection from water damage to building, structure, or building contents as required.
    - a. Install temporary sealant and backer materials to all open joints to prevent intrusion of water into the interior of the structure from pressure spraying.
  - 2. Protect trees and plants around the building from contamination or damage.
  - 3. Provide protection for glass during chemical cleaning of concrete.
  - 4. Protect the abutting finished surfaces from contact with chemical cleaners of type indicated by use of liquid strippable masking agent or polyethylene film and waterproof masking tape.
    - a. In particular, take special care protecting all metal finishes, fixtures, and hardware. Review site and identify with Owner those items which may be removed for storage prior to masonry cleaning.
  - 5. Protect all concrete and masonry surfaces not receiving cleaning treatment with polyethylene covers or other approved means.

- B. Protect existing drainage systems: Provide a method to prevent solids such as masonry residue from entering the drains or drain lines. Contractor shall be responsible for cleaning out drains and drain lines that become blocked or filled by sand or other solids because of work performed under this Contract.
- C. Protect Owner's staff and public: Take all necessary precautions to protect people, whether engaged in the work of this project or not, from all materials and operations of the masonry cleaning operation.
- D. Preparation of surfaces.
  - 1. Carefully remove surface debris, bird droppings, excess tar, and similar disfigurement by scraping or brushing methods prior to washing.
  - 2. Remove all dry powdery deposits by brushing with dry bristle brushes. Do not use wire brushes.
  - 3. Remove lichens and other biological growths by scraping with wood or plastic implements. Do not use metal scrapers for this operation.
  - 4. Concrete Masonry Units: Remove projecting joint mortar so it is even with the plane of the wall. Remove surface contaminants such as efflorescence, existing paint or coatings, or any other surface contamination by chemical or mechanical means. Pre-moisten the surface with water just prior to placement of air barrier. Verify adhesion with load tests after stucco/air barrier assembly has fully cured (28 days) on mock-up wall, and throughout the project as directed.

### 3.3 STUCCO INSTALLATION – GENERAL

- A. Coordinate work with other trades to ensure air barrier continuity with connections at foundation, floor lines, flashings, lintels and shelf angles, openings and penetrations such as pipes, vents, windows and doors, masonry anchors, rafters or beams, joints in construction, projections such as decks and balconies, and roof line.
- B. Transitions: Install air barrier accessory material or auxiliary material at transition areas: foundation, floor lines, flashings, lintels and shelf angles, openings and penetrations such as pipes, vents, windows and doors, masonry anchors, rafters or beams, joints in construction, projections such as decks and balconies, and roof line.

### 3.4 INSTALLATION OF CONTROL AND EXPANSION JOINTS

- A. Expansion and Control Joints: Continuous expansion and control joints shall be installed at locations in accordance with ASTM C1063 and ASTM C926.
  - 1. Substrate movement, and expansion and contraction of Stucco Assembly System and adjacent materials shall be taken into account in design of expansion joints, with proper consideration given to sealant properties, installation conditions, temperature range, coefficients of expansion of materials, joint width to depth ratios, and other material factors. Minimum width of expansion joints shall be as specified by the designer or shown on the project drawings.
- B. Install trim pieces in accordance with manufacturer's instructions and the following:
  - 1. Locate drip screed continuous on lower edge of soffit face.

2. Locate weep screed continuous at bottom edge of plaster along foundation.
  3. Locate casing bead to terminate plaster at windows, doors and all termination points except where other trim pieces are specified or detailed.
- C. Locate exterior control joints approximately 12 feet in each direction, coordinated with location of existing control/expansion joints.
1. Each continuous vertical area (panel) shall not exceed 144 square feet.
  2. No panel shall have a length-to-width ratio greater than 2-1/2 to 1.
  3. Provide joints at all movement joints in substrate.
- D. After initial set, scribe contraction joints in exterior work every 3 feet in each direction by cutting through 2/3 of the cement plaster depth, neatly, in straight lines.

### 3.5 PLASTERING - THREE COAT SYSTEM

- A. Apply plaster base coats in accordance with PCA Portland Cement Plaster (Stucco) Manual and finish coat in accordance with manufacturer's instructions.
- B. Apply scratch coat (first base coat) to completely embed the lath. Coat should be approximately 1/4 of an inch thick from face of lath and be left rough to accept the brown coat. Allow scratch coat to cure for a minimum period of 6 days. Spray dampen each day.
- C. Dampen scratch coat immediately before applying brown coat.
- D. Apply brown coat (second base coat) to a nominal thickness of 1/4 inch. Rod brown coat straight and true and leave with a rough texture to accept finish coat. Allow brown coat to cure for period of 7 to 10 days. Spray dampen each day with fine mist spray.
- E. Dampen brown coat for 2 days immediately before applying finish coat.
- F. Apply finish coat as recommended by manufacturer, to nominal thickness of 1/8 inch over substrate.
- G. Avoid excessive working of surface. Delay troweling as long as possible to avoid drawing excess fines to surface.
- H. Moist cure finish coat the day following application.
- I. After initial set, scribe contraction joints in work every 3 feet in each direction as indicated on reflected ceiling plan by cutting through 2/3 of the cement plaster depth, neatly, in straight lines.

### 3.6 TOLERANCES

- A. Maximum variation from true flatness of 1/8 inch per 10 feet, noncumulative.

### 3.7 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris and plaster deposits.

- B. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of plaster and other materials installed under this Section.

End of Section



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Section 09 29 00  
GYPSUM BOARD

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
  - 1. Taped, compounded and sanded gypsum board finishes.
  - 2. Abuse resistant gypsum board.
  - 3. Non-combustible, fire-resistant fireplace enclosure board.
  - 4. All trim and accessory components related to gypsum board work.
  - 5. Acoustical joint sealant and backing at perimeter of gypsum board partitions.
  - 6. Factory prefabricated partition closure mullions where gypsum board partitions terminate at windows, curtainwall and storefront framing
- B. Install access panels occurring in gypsum board work furnished by Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing finishes, partitions and walls as indicated in the Drawings.
- D. Section 06 10 00 - ROUGH CARPENTRY:
  - 1. Supplemental wood framing and blocking supporting gypsum board.
  - 2. Installation of metal door frames in gypsum board work.
- E. Section 07 21 00 - THERMAL INSULATION.
- F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing steel door frames.
- G. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in partitions and walls.

- H. Section 09 21 17 - SHAFT WALL ASSEMBLIES: Pre-engineered fire-resistant assemblies including framing and liner boards. Interior Finishing work performed under this Section 09 29 00.
- I. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING:
  - 1. Non-load bearing partition, ceiling and soffit framing and furring.
  - 2. Deflection track assemblies at tops of metal stud partitions.
  - 3. Resilient sound isolation clips for all gypsum board (drywall) ceilings, and for sound isolation partitions (refer to Drawings for types and locations).
- J. Section 09 30 00 - TILING: Ceramic tile finishes over backer board substrate installed by this Section 09 29 00.
- K. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceilings.
- L. Section 09 81 00 – ACOUSTICAL INSULATION: acoustical batt insulation.
- M. Section 09 91 00 - PAINTING: Applied finish coatings.
- N. Section 10 40 00 - SAFETY SPECIALTIES.
- O. Division 21 - FIRE SUPPRESSION: Sprinkler heads in ceiling system.
- P. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Supply and return air registers.
- Q. Division 26 - ELECTRICAL: Independent hangers for suspended lighting fixtures.

#### 1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM C 475 - Joint Treatment Materials for Gypsum Wallboard Construction.
  - 2. ASTM C 557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
  - 3. ASTM C 630 - Water Resistant Gypsum Backing Board.
  - 4. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
  - 5. ASTM C 919 - Use of Sealants in Acoustical Applications.
  - 6. ASTM C 1002 - Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
  - 7. ASTM C 1047 - Accessories for Gypsum Wallboard and Veneer Base.
  - 8. ASTM C 1396 - Gypsum Wallboard.
  - 9. ASTM C 1658 - Glass Mat Gypsum Panels.
    - 1. ASTM C 1658 - Glass Mat Gypsum Panels.
    - 2. ASTM D 3678 - Polyvinyl chloride material for indoor exposure.

3. ASTM D 1784 - Polyvinyl chloride material for outdoor exposure.
4. ASTM E 90 - Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
5. ASTM E 119 - Fire Tests of Building Construction and Materials.
6. GA 201 - Gypsum Board for Walls and Ceilings.
7. GA 214 - Recommended Specifications for Levels of Gypsum Board Finish, Glass Mat and Fiber-Reinforced Gypsum Panels.
8. GA 216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
9. GA 220 - Recommended Specifications for Gypsum Board Winter Related Job Problems.
10. UL - Fire Resistance Directory.
11. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
12. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
2. Work of this Section shall be closely coordinated with the work of Section 05 40 00 - COLD-FORMED METAL FRAMING and Section 09 22 16 - NON-STRUCTURAL METAL FRAMING, to assure the steady progress of the Contract.
3. Work of this Section shall be closely coordinated with the work of Section 06 10 00 - ROUGH CARPENTRY, to assure the steady progress of the Contract.

- ##### B. Sequencing: Do not install gypsum board until all pipes, ducts, conduits, and other such items which are to be enclosed thereby, have been permanently installed, inspected and approved.

#### 1.6 SUBMITTALS

##### A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
2. Shop Drawings:
  - a. Details of any special conditions associated with fireproofing.
  - b. Mark-up a set of blackline interior elevations indicate corrections to grid layout and provide dimensioning showing locations of all proposed control joints and expansion joints.
    - 1) Provide interior elevation drawings for interior elevations which are not included as part of the Contract Drawing set.
3. LEED Submittal Requirements:

- a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
  - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
    - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
    - b) EPD shall have at least Cradle to Gate scope,
  - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
  - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
    - a) Itemized vendor invoices for FSC-certified products.
    - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
  - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
- c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
  - 1) Recycled Content:
    - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
    - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
  - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
    - a) Documentation should be in the form of one of the following:
    - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
    - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
    - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
    - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
    - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher

- 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (ceilings):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for ceilings, walls, thermal and acoustical insulation products installed within the waterproofing membrane.

#### 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum board.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Storage and Handling Requirements:
1. Store materials inside, under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
    - a. Neatly stack board materials flat to prevent sagging.
  2. Handle board materials so to prevent damage to edges, ends and surfaces.
  3. Protect trim, accessories and corner beads from being bent or damaged.

1.9 SITE CONDITIONS

- A. Environmental Conditions: In accordance with GA 216, maintain minimum ambient temperature of 50 degrees Fahrenheit 48 hours before, during taping and compounding, and until completely dry thereafter.

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
1. Gypsum board products:
    - a. United States Gypsum Company, Chicago IL. (USG).
    - b. National Gypsum Company, Charlotte NC. (Gold Bond and ProForm Brands).
    - c. G-P Gypsum Corporation, Atlanta GA.
    - d. Continental Building Products, Hendron VA.
  2. Metal trim and accessories:
    - a. Bailey Metal Products Ltd., Ville Mont-Royal, Quebec, Canada
    - b. ClarkDeidrich Metal Framing, Pittsburgh PA.
    - c. National Gypsum Company, Gold Bond Products Division, Charlotte NC. (Gold Bond and ProForm brands).
    - d. United States Gypsum Company, Chicago IL. (USG).
  3. Reveal trim:
    - a. Fry Reglet Corporation, Norcross GA.
    - b. Gordon Inc., Shreveport LA.
    - c. Pittcon Industries, Inc., Riverdale MD.
    - d. Stockton Products, North Las Vegas, NV.

4. Joint sealants:
  - a. Tremco, Beachwood OH.
  - b. Pecora Corporation, Harleysville PA.
  - c. Owens Corning, Toledo OH.
  - d. Specified Technologies, Inc. (STI), Somerville NJ.
- B. The design and details as shown on the Drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

## 2.2 DESCRIPTION

- A. Regulatory Requirements
  1. Fire resistance ratings: Where gypsum board systems with fire-resistance ratings are indicated, provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters.
  2. Seismic Compliance: Nonstructural components that are permanently attached to structures and their support attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance to local jurisdiction.
  3. Gypsum Board Recycled Content: Minimum 10 percent post-consumer recycled content, or minimum 40 percent pre-consumer recycled content at contractor's option.

## 2.3 BOARD MATERIALS

- A. Non-rated and Fire rated gypsum board {for wall fire resistant ratings 120 minutes and less} (designated GWB-1, typical walls and rated ceilings): UL fire resistance rated, ASTM C 1396 'Type X' board, 5/8 inch thick, 48 inch width, of lengths to minimize end joints, with tapered edges.
  1. Acceptable products include the following, or approved equal:
    - a. USG Sheetrock brand "Firecode Core"
    - b. National Gypsum Company, Gold Bond brand product "Fireshield Gypsum Board".
    - c. G-P Gypsum Corporation product, "ToughRock Fireguard".
    - d. Continental Building Products, product "Firecheck Type X".
- B. Sag-resistant gypsum board ceiling panels (GWB-1, non-rated ceilings): Non-rated 1/2 inch thick, 48 inch width, of lengths to minimize end joints, with tapered edges, conforming to ASTM C 1396.
  1. Acceptable products include the following or approved equal:
    - a. USG Sheetrock brand product "Ultralight Panels Mold Tough".
    - b. National Gypsum Company, Gold Bond brand product "High Strength Ceiling Board".



- c. G-P Gypsum Corporation product, "ToughRock CD Ceiling Board".
    - d. Continental Building Products, product "Sagcheck".
  2. At fire-resistant rated ceilings, provide 5/8 inch thick fire-rated gypsum board as specified herein.
- C. Abuse-Resistant Gypsum Board (designated GWB-3): UL type FRX fire resistance type, ASTM C-1278 board, complying with ASTM C1658 and ASTM C36.
  1. ASTM C1629 Test Result Characteristics, minimum Level ratings:
    - a. Abrasion: Level 2.
    - b. Indention: Level 1.
    - c. Soft Body Impact: Level 2.
    - d. Hard Body Impact: Level 1.
  2. Acceptable products include the following or approved equal:
    - a. USG Sheetrock brand product "Moldtough AR", or "Fiberock AR panels".
    - b. National Gypsum Company, Gold Bond brand product "Hi Abuse XP".
    - c. G-P Gypsum Corporation product, "Dense Armor Plus Abuse".
    - d. Continental Building Products, product "Protecta AR 100 Type X with Mold Defense".
- D. Paperless moisture and mold resistant board (designated GWB-2): 5/8 inch thick Glass mat, water-resistant, mold-resistant interior wall panel: Coated inorganic glass mat-faced, with Type "X" water-resistant, treated core gypsum wallboard. Physical properties conforming to the applicable sections of ASTM C 1177 and ASTM D 3273.
  1. Acceptable products include the following or approved equal:
    - a. USG Sheetrock brand product "Mold-Tough Firecode X".
    - b. National Gypsum Company, Gold Bond brand product "eXP Interior Extreme Gypsum Panel".
    - c. G-P Gypsum Corporation product, "DensArmor Plus Paperless Interior Panel".
    - d. Continental Building Products, product "Weather Defense Platinum Interior, Type X".

## 2.4 TRIM AND EDGE COMPONENTS

- A. Metal trim accessories:
  1. Corner beads: 1-1/4 by 1-1/4 inch corner bead for finishing with joint compound fabricated from galvanized steel conforming with ASTM C-1047.
    - a. Acceptable products include the following or approved equal:
      - 1) Bailey Metal Products Ltd., model D100
      - 2) ClarkDeidrich Metal Framing, model CBS.
      - 3) Gold Bond product, 1-1/4 inch Wallboard Corner Bead.
      - 4) USG product "Dur-A-Bead - number 103"
  2. Casing beads: Edge casing bead with 1/2 inch back leg, for finishing with joint compound fabricated from galvanized steel conforming with ASTM C-1047.

- a. Acceptable products include the following or approved equal:
    - 1) Bailey Metal Products Ltd., model D-200
    - 2) ClarkDeidrich Metal Framing, model M20B.
    - 3) Gold Bond product, Wallboard Casing number 100.
    - 4) USG product "Dur-A-Bead - number 200A"
  3. Control joints: Solid zinc "V-shaped control joint, having 3/32 inch thick perforated grounds.
    - a. Acceptable products include the following or approved equal:
      - 1) Bailey Metal Products Ltd., model 'zinc control joint'
      - 2) ClarkDeidrich Metal Framing, model 093
      - 3) Gold Bond model 093 zinc.
      - 4) USG product "Control Joint - number 093.
- B. Paper faced trim accessories for use with Abuse Resistant Gypsum Board:
1. Corner beads (at outside corners): Paper-faced galvanized steel sheet for finishing with joint compound conforming with ASTM C-1047, equal USG product "Sheetrock" Brand Paper-Faced Metal Corner Bead.
    - a. Provide curved-edge cornerbead with notched or flexible flanges at curved openings.
  2. Casing beads: Paper-faced galvanized steel sheet for finishing with joint compound conforming with ASTM C-1047, equal to USG product "Sheetrock" Brand Paper-Faced Metal Beads and Trims.
    - a. LC-Bead (J-Bead): Use at exposed panel edges.
    - b. L-Bead: Use where indicated
    - c. U-Bead: Use where indicated.
  3. Control joints: Solid zinc "V-shaped control joint, having 3/32 inch thick perforated grounds, equal to USG Control Joint No. 093.
- C. Reveal trim: extruded aluminum trim with 1/4 inch wide recess by nominally 5/8 inch deep reveal channel with punched tapered fins.
1. Fry Reglet Corporation, model number: DRM-625-25
  2. Gordon Inc.: R-Series, 514-5/8.
  3. Pittcon Industries, Inc., model number: SWR-025-063.
  4. Stockton Products, model number: DRM, X=1/2, Y=1/4

## 2.5 ACOUSTICAL PARTITION CLOSURE MULLION TRIM

- A. General: Provide sound barrier mullion trim caps of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
1. Furnish units in lengths of sufficient additional length to allow for field trimming to required length to match variations in construction tolerances of adjacent systems.
- B. Partition closures: Adjustable partition closure at transition between windows and partition walls, in sizes as indicated on the Drawings,

1. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Mull-it-Over Products, Grand Rapids, MI., model: [55 Classic Mullion Trim Cap] [55 Flush Mullion Trim Cap] [55 Wide Mullion Trim Cap] [60 Classic Mullion Trim Cap] [60 Flush Mullion Trim Cap] [60 Wide Mullion Trim Cap] [Custom]
  - a. No substitution will be accepted.
2. Sound absorbing foam:
  - a. Resistant to smoke, flame, and microbial growth.
  - b. Fire Rating: ASTM E 84 Class 1.
  - c. Fungi Resistance: Zero rating per ASTM G 21.
3. Acoustical Performance:
  - a. Single Sided Installations: STC 50 or higher.
  - b. Double-Sided Installations: STC 55 or higher.
  - c. Double-Sided Installations: STC 60 or higher.
4. Compressible Foam: Between edge of extrusion and interior face of curtain wall glass
  - a. Thickness: Standard 1/2 inch (12.7 mm), or 1 inch (25.4 mm) to accommodate a larger mullion deflection as indicated on approved shop drawings.
5. Finish: Custom to match curtain wall.

## 2.6 ACCESSORIES

- A. Tapes and compound:
1. Joint tape (at paper-faced gypsum): Nominal 2 inch wide, high strength, cross-fibered paper drywall tape.
  2. Joint tape (at fiberglass faced gypsum): Nominal 2 inch wide, self adhering (adhesive backed), fiberglass mesh tape.
  3. Joint Compound for setting fiberglass joint tape:
    - a. Cetainteed, Valley Forge PA., product "ProRock Moisture and Mold Resistant 90".
    - b. Georgia Pacific Gypsum LCC., Pittsburgh PA, product "Densarmor Cote"
    - c. CTS Cement Manufacturing Corporation, Cypress CA., product "Rapid Set OnePass".
  4. Joint Compound for setting paper joint tape: 'Speed-setting type compound', field mixed.
    - a. Acceptable products, or approved equal:
      - 1) USG product "Durabond 20".
      - 2) ProForm Brand product "ProForm QuickSet 20".
      - 3) Georgia Pacific Gypsum LCC, product "ToughRock All-Purpose Dry Mix"
  5. Joint Compound for finishing: field mixed joint compound or factory pre-mixed compound.
    - a. Field-mixed compounds: acceptable products, or approved equal:

- 1) USG product "Durabond 90".
  - 2) ProForm Brand product "ProForm QuickSet 90".
  - 3) Georgia Pacific Gypsum LCC, product "ToughRock Setting Compound 90".
- b. Factory pre-mixed compounds: acceptable products, or approved equal:
- 1) USG product "Ready-Mixed Joint Compound".
  - 2) ProForm Brand product "ProForm All Purpose Compound".
  - 3) Georgia Pacific Gypsum LCC, product "ToughRock Ready Mix All-Purpose Compound"
- B. Fasteners (interior board systems):
1. Type S, bugle head screws complying with ASTM C 1002, for applying gypsum board to metal framing, ceiling grid system, and furring channels.
    - a. Not less than 1 inch long for single layer gypsum board.
    - b. Not less than 1-5/8 inch [41mm] long for double-layer gypsum board.
  2. Type S-12, fine thread self-drilling screws complying with ASTM C 1002, for applying gypsum board to light gage metal framing.
    - a. Not less than 1 inch [25 mm] long for 1/2 inch thick single layer gypsum board.
    - b. Not less than 1-1/4 inch [31mm] long for 5/8 inch thick single layer gypsum board.
    - c. Not less than 1-5/8 inch [41mm] long for double-layer gypsum board,
- C. Ceiling buttons, perforated type, 1 inch diameter, for use at multiple layered gypsum board ceiling systems.
- D. Laminating adhesive: Ready mix joint compounds as specified herein above.
- E. Acoustical compound (used between layers of gypsum board): Single component non toxic, low VOC, acoustical damping compound.
1. Performance criteria:
    - a. Flammability: per ASTM E-84, Flame Spread 0, Smoke Index 0.
    - b. Flash point: greater than 200 degrees F.
  2. Acceptable Products, or approved equal.
    - a. Green Glue Company, (Saint-Gobain Performance Plastics) Granville NY, product "Green Glue Compound".
    - b. Kinetics Noise Control, Dublin OH., product "KDC-E-162 Damping compound".
    - c. Oeler Industries Inc., Pittsburgh, PA., product: "Prospec Decibel Drop".
- F. Joint Sealers (Acoustical Sealant): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable.
1. Acceptable products include the following, or approved equal.
    - a. Owens Corning, product: "QuietZone Acoustical Sealant."
    - b. Pecora Corporation, Harleysville PA.; product " AC-20 FTR".

- c. Specified Technologies, Inc. (STI), product "Smoke 'N" Sound Acoustical Sealant".
  - d. Tremco, Beachwood OH.; product, "Acoustical Sealant".
- G. Liquid sealer for cuts, holes and ends of moisture resistant board; provide one of the following or acceptable equal.
- 1. Shellac type sealer: mix 4 pounds of orange or bleached shellac dissolved in 1 gallon of denatured ethyl-alcohol.
  - 2. Varnish type sealer: Fast setting marine varnish.

## 2.7 SOURCE QUALITY CONTROL

- A. Obtain gypsum board and finishing products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that all items which are to be enclosed by Work of this Section, have been permanently installed, inspected and approved.
- B. Inspect framing and other substrates; verify that they are in proper condition to receive the work of this Section.
- C. Beginning of installation means acceptance of existing substrate and site conditions.

### 3.2 PREPARATION

- A. During the operation of gypsum board work, protect all wood, metal, glass, flooring, and other finished materials against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

### 3.3 INSTALLATION - GENERAL

- A. General: Perform erection procedures for the various gypsum board system conditions, except as otherwise specified, as set forth in GA 201, GA 216, GA 220, the written instructions of gypsum board manufacturer, together with the additional requirements specified herein and as indicated on the Drawings.
- B. Where fire-resistive rated assemblies are indicated, erect gypsum board systems in strict accordance with the manufacturers' UL listed test constructions for the required fire rating on each specific assembly.
- C. Install specified control joints where indicated on Drawings and where run of partitions, or furred surfaces exceeds 30 feet. Show locations of all control joints on shop drawings.
  - 1. Locate control joints at corners of head frames of doors.
  - 2. Run vertical control joints continuously to top of partition, shaft wall or furred area, as applicable.

### 3.4 INSTALLATION OF EXTERIOR GYPSUM CEILING BOARD SOFFITS

- A. Install exterior gypsum ceiling board soffits similar to interior gypsum board ceilings. Install molding trim continuously at all edges and control joint molding at control joints. Space control joints no greater than 30' apart, at intersection of "L", "U" or "T" shaped areas, around columns and other penetrations, and elsewhere as recommended by the manufacturer.

### 3.5 INSTALLATION OF GYPSUM BOARD

- A. Screw fasten only, gypsum board to framing and furring, with ends and edges occurring over firm bearing. At all door jambs screw fasten gypsum panels 8 inches on center to both box studs
  1. Erect single layer fire-resistance rated gypsum board vertically.
  2. Erect standard and moisture resistant layer board in most economical direction.
  3. Erect ceiling and soffit gypsum boards to meet UL requirements, where applicable, stagger end joints over supports. Secure gypsum board with fasteners inserted through ceiling buttons; anchor fasteners directly to framing or suspended support system.
- B. Wherever items penetrate the gypsum board surfaces, use extra care in cutting the gypsum board to ensure a uniformly-dimensioned joint between the penetrating item and the gypsum board, and fill joints with specified sealant material. Verify the expected deflection factor of the penetrating members, and cut the gypsum accordingly, to prevent damage thereto from the deflecting members.
- C. Treat cut edges and holes in moisture resistant gypsum board with approved liquid sealer.
  1. If shellac is used, apply in thin layers to dry quickly.
- D. Installing Trim Accessories:
  1. General: For trim with back flanges intended for fasteners, attach to framing with same screw fasteners used for gypsum board. Otherwise, attach trim according to manufacturer's written instructions.
    - a. Nailing, stapling, or crimping methods to install trim components is prohibited.
  2. Install corner beads at all exterior corners of gypsum boards.
  3. Install casings (PVC trim) wherever gypsum board meets a dissimilar material, and in other locations indicated on the Drawings, except at floors where bottom of the board will be concealed by base, integral with flooring, resilient base, wood base or carpeted base.

### 3.6 INSTALLATION OF ACOUSTICAL DAMPING COMPOUND

- A. Surface Preparation: remove dirt and clean surfaces..
- B. Application: Compound can be sprayed or troweled using an airless high-pressure pump. It is suggested for large volume applications:
  1. Pump Ratios be 20:1, 30:1, or 40:1.
  2. Tip Sizes, minimum: 0.051 inch.

- C. Coverage and thickness: A coverage rate of 11.4 sq. ft./gal. is attained at a 9/64 inch wet thickness.
- D. Drying Time: A 9/64 inch thick coating is dry to the touch within twelve (12) hours and completely air dries to a hard, firm surface in 24 to 40 hours. Drying time can be accelerated by the application of heat. Maximum recommended temperature is 150° F.
- E. Temperature and Storage Limitations: Since this is a water-based emulsion, it is recommended storing in areas above freezing temperatures (32° F). Shelf life is limited to 3-4 months.
- F. Clean Up: Damping Compound can be cleaned from tools and surfaces with the use of water

### 3.7 INSTALLATION OF REVEAL TRIM

- A. General: Install reveal trim in accordance with trim manufacturer's recommendations and as follows:
  - 1. Lay out drywall surface with chalk lines to exact heights and locations indicated. Cut out gypsum board with router.
  - 2. Cut extrusions to proper lengths and dry-fit to drywall. Miter all corners for hairline joints.
  - 3. Screw install trim through at 8 inches on center maximum with standard bugle head drywall screws.

### 3.8 INSTALLATION OF MULLION CLOSURE TRIM

- A. General: Install mullion closure trim in accordance with manufacturer's recommendations.

### 3.9 APPLICATION OF ACOUSTICAL SEALANT

- A. General: Install sealant and backing in accordance with the recommendations of ASTM C-919 and sealant manufacturer's recommendations.
  - 1. Perform preparation in accordance with C-790. Thoroughly clean all joints, removing all loose mortar, oil, grease, dust, frost, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
  - 2. If so recommended and furnished by the specific sealant manufacturer, apply primer to all joint surfaces, taking care not to stain adjacent surfaces.
- B. Seal all partition perimeters prior to taping or compounding. Where perimeters are edged with metal trim, apply sealant and backing material between trim and dissimilar material.
- C. Seal all penetrations in partition types designated for "acoustical" insulation. Penetrations to receive sealant include electrical boxes, plumbing, heating and air conditioning ducts, telephone, intercom hookups and similar items.
  - 1. Install joint bead back-up in all joints in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.

- a. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
  - b. Do not stretch back-up material into joints.
  - c. Install bond breaker wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.
2. Apply sealant in continuous beads without open joints, voids or air pockets
    - a. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
  3. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

### 3.10 APPLICATION OF JOINT TREATMENT

- A. Install joint tape at all joints where gypsum boards abut and where boards form internal corners, whether or not such joints will be concealed from view.
- B. Apply compound to all joints, edges, corners, fastener head depressions and abrasions in the surfaces, whether or not such conditions will be concealed from view. Sand completely smooth all compound surfaces, which will be exposed to view, and leave ready to receive applied coatings or finish.
- C. Provide the minimum levels of gypsum board finishes as defined by the Gypsum Association recommended specifications GA-214 and GA-216, per the following:
  1. At areas hidden from view, except as otherwise specified: Level 1.
  2. At areas hidden from view, requiring a fire rating: Level 1.
  3. At concealed plenum spaces above ceilings: Level 1.
  4. At non-occupied spaces: Level 1.
  5. At surfaces scheduled to receive "flat" (without any sheen), "pearlescent", and egg-shell low-gloss painted finishes: Level 4.
  6. At surfaces scheduled to receive painted finishes with semi-gloss and gloss sheen and all fiberglass faced board: Level 5.

End of Section



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Section 09 30 00

TILING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Floor tile (designated PCT-1 and PCT-2).
  - 2. Wall tile (designated PCW-1 and PCW-2).
  - 3. Tile base and associated trim (designated PCB-1 and PCB-2).
  - 4. Stone thresholds and saddles.
  - 5. Fluid applied waterproofing membrane at wet floor areas occurring over occupied spaces and where additionally indicated.
  - 6. Anti-fracture membrane at slab on grade conditions and "dry" flooring areas.
  - 7. Cementitious tile backer board.
  - 8. Installation systems, adhesives, mortars and grouts.
  - 9. Control joints in tiled floors.
- B. Install the following furnished under the designated Sections:
  - 1. Install access panels into tiled walls as specified under Section 08 31 00 - ACCESS DOORS AND PANELS.
- C. Perform drilling and cutting in tile surfaces, as required to accommodate penetrating items of other trades, from templates and instructions furnished by the respective trades.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete slab substrate.
- D. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.
- E. Section 07 92 00 - JOINT SEALANTS: Backer rod and sealant at control joints.

- F. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: access panels, occurring in partitions and walls.
- G. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal stud framing to receive cementitious backer board installed under this Section.
- H. Section 10 28 13 - TOILET ACCESSORIES: Furnishing toilet accessories and installation templates.
- I. Division 22 - PLUMBING: Floor drains.
- J. Division 26 – ELECTRICAL: Receptacles/outlets.

#### 1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. . Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. .
  - 1. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
  - 2. ANSI A108.6 - Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.
  - 3. ANSI A108.9 - Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.
  - 4. ANSI A108.10 - Installation of Grout in Tilework.
  - 5. ANSI A108.11 - Interior Installation of Cementitious Backer Units.
  - 6. ANSI A118.1 - Dry-Set Portland Cement Mortar.
  - 7. ANSI A118.3 - Chemical-Resistant, Water-Cleanable, Tile Setting and Grouting Epoxy and Water-Cleanable Tile Setting Epoxy Adhesive.
  - 8. ANSI A118.4 - Latex-Portland Cement Mortar.
  - 9. ANSI A118.6 - Ceramic Tile Grouts.
  - 10. ANSI A118.7 – Polymer Modified Cement Grouts
  - 11. ANSI A118.8 - Modified Epoxy Emulsion Mortar/Grout.
  - 12. ANSI A118.9 - Cementitious Backer Units.
  - 13. ANSI A118.10 - Waterproofing.
  - 14. ANSI A137.1 - Specifications for Ceramic Tile.
  - 15. ANSI A10.20 - Safety Requirements for Ceramic Tile, Terrazzo and Marble Work.
  - 16. ASTM C 627 - Evaluating Ceramic Floor Tile Installation Systems.
  - 17. ASTM C 920 - Specifications for Elastomeric Joint Sealant.
  - 18. ASTM E 119 – Fire Test of Building Construction and Materials.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
  - 1. TCNA (formerly TCA) - Handbook for Ceramic Tile Installation, latest edition.

- C. Definitions: For the purposes of these specifications the following terms are defined:
  - 1. Wet Areas: Rooms/spaces which has plumbing fixtures, sinks, toilets, or floor drains. Wet areas additionally include rooms/spaces which are exposed to weather.
  - 2. Dry Areas: Rooms/spaces which have no plumbing, sinks, toilets, or floor drains.

## 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-installation meetings:
  - 1. At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
    - a. Required attendees: Architect, General Contractor, Tile Installer's Project Superintendent, Tile setting materials manufacturer's technical representative and representatives for installers of related work specified under the following Sections:
      - 1) Section 09 29 00 – GYPSUM BOARD.
    - b. Agenda:
      - 1) Scheduling of tiling operations.
      - 2) Review of setting methods and materials required.
      - 3) Review of staging and material storage locations.
      - 4) Coordination of work by other trades.
      - 5) Protection of completed tile work.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
    - a. Include maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
  - 2. Shop Drawings: 1/4 inch scale elevations and plans of tile patterns.
  - 3. Selection Samples:
    - a. Manufacturer's sample boards for each type and color group of tile specified, and grout colors, for selections by the Architect.
  - 4. Verification Samples:
    - a. Mount tile and apply grout on one 24 by 24 inch cement backerboard board, for each tile type and selected color, to indicate color and texture variations, tile flatness and joint size variations.

- b. Trim shapes and base, in selected colors in types and shapes indicated for project conditions.
  - c. Stone threshold, 12 inch long samples in shaped profile.
5. Source Quality Control Submittals:
- a. Grade Certificates: Manufacturer's Master Grade Certificates submitted prior to shipment of tile to project.
    - 1) Comply with ANSI A137.1 for special purpose tiles.
6. LEED Submittal Requirements:
- a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
    - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
      - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
      - b) EPD shall have at least Cradle to Gate scope,
    - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
    - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
      - a) Itemized vendor invoices for FSC-certified products.
      - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
    - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
  - c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
    - 1) Recycled Content:
      - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
      - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
    - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
      - a) Documentation should be in the form of one of the following:
      - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)

- c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
  - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
  - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
  - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
- 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.

- 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.
- f. Indoor Environmental Quality Credit 3: Low-Emitting Materials (flooring systems):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for flooring systems installed within the waterproofing membrane.
- B. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
  1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra materials in, an amount equal to 3 percent of tile and trim of each color, finish and type installed.

#### 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
  1. Conform to ANSI/TCNA A 137.1 and TCNA Handbook for Ceramic Tile Installation.
  2. Tiles delivered to the job or installed in the work which do not fall within the accepted color and texture range demonstrated by the samples shall be removed from the site and replace with acceptable materials.
- B. Sole Source: Obtain installation products required for the Work of this Section from a single manufacturer.
- C. Qualifications:
  1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

#### 1.8 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Provide mock-up panels, minimum 160 square feet, illustrating color, texture and finish, and demonstrating the minimum standard for the Work.

1. Mock-up will demonstrate quality of work, construction methods, color and texture of tile, flatness of installation, joint spacing and color of grout. Include typical tile accessories and a control joint.
2. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
3. Accepted mock-ups may not remain as part of the work; the number of mock-ups shall not be restricted.

#### 1.9 DELIVERY, STORAGE AND HANDLING

##### A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
2. Deliver tile in manufacturer's sealed cartons, grade-sealed by the manufacturer in accordance with ANSI A 137.1, with grade-sealed unbroken, and clearly marked as to contents, color, and quantity.
3. Deliver and store tile setting materials in original, sealed, containers showing manufacturer's identification, year of production, net weight, date of packaging, and location of packaging.

##### B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Store waxed tile in manner keeping wax off the sides and backs of the units.
3. Store and protect containers above floor level, keep dry until ready for use.
4. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions. Store epoxy mortar and epoxy grouts at 70 degrees Fahrenheit (21° C) temperature for 24 hours prior to use.

#### 1.10 SITE CONDITIONS

##### A. Environmental conditions:

1. General: Maintain ambient temperatures between 50 (10° C) and 80 (26° C) degrees Fahrenheit in tiled areas, for 24 hours prior to installation, during installation and for 7 days after completion.
2. Special environmental conditions for epoxy setting and grout materials: Maintain ambient temperatures between 65 degrees Fahrenheit (18° C) and 80 degrees Fahrenheit (27° C) in tiled areas, for 24 hours prior to installation, during installation and for 7 days after completion.
3. When temperature of substrate exceeds 90 (32° C) degrees Fahrenheit, contact manufacturer for instructions.

##### B. Do not install setting or grouting materials in a closed, unventilated environment. Ventilate propane or fossil fuel heaters to prevent damage to tile work from carbon-dioxide build up.

##### C. Shade work areas in direct sunlight during installation to prevent rapid evaporation caused by excessive heat.



## 1.11 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manufacturer Warranty: The manufacturer of installation systems, adhesives, grouts and mortars shall provide a comprehensive non pro-rated written five (5) year warrantee against defective products which covers replacement materials and labor costs for demolition, tile accessories, and installation systems.
  - 1. Warranty to provide for tile lifting or separation from substrate, and setting bed/grout deterioration, when products have been installed with referenced TCNA setting systems using specified setting and grout materials.
  - 2. Warranty excludes structural failure, movement or cracking of substrate materials, and workmanship performed not in accordance with manufacturer's instructions and industry standard guidelines.
- C. Special Warranty: Provide 2 year, non pro-rated warranty which shall include provisions for cracking, breakage or failure of tile due to defective workmanship
  - 1. Materials must be compatible and from one source, single source responsibility for waterproofing, installation, mortars and grouts. Job-site mixtures of sand portland cement and site dilution of additives shall not be permitted.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following or approved equal:
  - 1. Porcelain tile and base:
    - a. Crossville Ceramics, Crossville TN.
  - 2. Mortars, adhesives & Grouts:
    - a. Custom Building Products, Inc., Seal Beach, CA.
    - b. Laticrete International, Inc., Bethany CT
    - c. Mapei Corporation, Elk Grove IL.
  - 3. Cementitious tile backer board ("Cement board"):
    - a. Custom Building Products, Inc., Seal Beach, CA.
    - b. Fin Pan, Inc., Hamilton OH.
    - c. Unifix, Inc., division of National Gypsum Company, Charlotte, NC.
    - d. United States Gypsum Company, Chicago, IL.
  - 4. Edging materials:
    - a. Schlüter Systems L.P., Plattsburgh NY.
    - b. Custom Building Products, Inc., Seal Beach, CA.
    - c. Ceramic Tool Company Inc., Waukesha WI.

## 2.2 PORCELAIN FLOOR AND BASE

- A. Floor Tile PCT-1: Crossville Ceramics, "Alaska" Series, Color "Ice", nominal 2x2 inch mosaic , by 10.5mm thick.
- B. Floor Tile PCT-2: Crossville Ceramics "Familiar Territory" Series, Color "Taupe", matte finish, nominal 2x2 inch mosaic by 3/8 inch thickness.

## 2.3 PORCELAIN WALL TILE AND BASE

- A. Porcelain Wall Tile (designated PCW-1): Crossville Ceramics, Color-by-Numbers" Series, "Tea for Two" gloss.
  - 1. Sizes as indicated.
- B. Porcelain Wall Tile (designated PCW-2): Crossville Ceramics, "Handwritten" Series, colors to be selected, up to 3 different colors may be selected, any price range.
  - 1. Sizes as indicated.

## 2.4 STONE THRESHOLDS

- A. Where indicated on the Drawings, provide marble thresholds complying with Class "A" of the Marble Institute of America, in color selected by the Architect from standard colors of the approved fabricator, shaped to provide a comfortable transition between tile and other floor finishes, with smooth matte surface finish and in the dimensions and thickness shown on the Drawings.

## 2.5 SETTING MATERIALS

- A. Thin-set polymer-modified Portland cement dry-set mortar, complying with the bond strength requirements of ANSI A118.4.
  - 1. Acceptable products are limited to:
    - a. Mapei product: "Kerabond" with "Keralastic" additive.
    - b. Laticrete product number 254 Platinum.
    - c. Custom Building Products " Porcelain Tile Mortar"
- B. Fluid applied waterproofing membrane: ASTM C627 classification "Extra Heavy". Two component liquid rubber membrane cold applied, load bearing, bonded, non-toxic, non-flammable, and non-hazardous, used with 20 mil (0.5mm) thick flexible nonwoven rot-proof polyvinyl chloride reinforcing fabric.
  - 1. Waterproofing membrane shall be IAPMO certified as shower pan liner under the International Plumbing Code.
  - 2. Waterproofing membrane shall provide crack suppression and isolation for anti-fracture per ANSI A118.12.5.4, spanning 1/8 inch (3mm) crack, and meet the following physical requirements:
    - a. Water Permeability (at 30ft.hydro/0.9 atmos/91.2kPa): Nil.
    - b. Elongation at break (ASTM D-751): 20 to 30%
    - c. Service Temperatures: -20° to +280°F. (-29°to +138°C).
    - d. Tensile breaking strength: 2950psi (20.4MPa;207kg/cm<sup>2</sup>)

- e. Bond strength to concrete: 350psi (2.4MPa;24kg/cm<sup>2</sup>)
- f. Resistance to chemicals (90 day immersion):
  - 1) Brine solution Not Affected.
  - 2) Sugar solution Not Affected.
  - 3) Milk Not Affected.
  - 4) 10% Citric Acid Not Affected.
  - 5) 3.5 percent HCl Acid: Not affected.
  - 6) 5% Acetic Acid: Not Affected
  - 7) 1% Alkali solution: Not Affected
  - 8) Urine: Not Affected
  - 9) Calcium chloride: Not Affected.
  - 10) Toluol Softens.
- g. Floor Tile Installation Evaluation (ASTM C627-81) 900 cycles
- h. Service Rating (TCNA) Extra Heavy Duty
- 3. Acceptable products are limited to:
  - a. Mapei product: "Mapelastic 315" with fabric reinforcing.
  - b. Laticrete product "Laticrete 9235 Waterproofing" with fabric reinforcing.
  - c. Custom Building Products "9240 Waterproofing".
- C. Anti-fracture membrane for crack suppression and substrate crack isolation. Two component system (liquid and fabric) complying with TCNA performance level: Extra Heavy Service".
  - 1. Acceptable products are limited to:
    - a. Mapei product: "Plani/Lastic".
    - b. Laticrete product "Blue 92".
    - c. Custom Building Products "Crack Buster Pro" or "Fracture Free".
- D. Cementitious tile backer board ("cement board"): 1/2-inch nominal thickness, glass fiber reinforced, with a minimum compressive strength of 1,250 pounds per square inch and minimum flexural strength of 750 pounds per square inch.
  - 1. Acceptable products include the following:
    - a. Custom Building Products, Inc. product "WonderBoard Lite" (7/16 inch thickness)
    - b. Fin Pan, Inc., product: "Util-a-Crete".
    - c. National Gypsum Company, Charlotte, NC. product "PermaBase".

## 2.6 GROUTING MATERIALS

- A. Epoxy grout: Multi-component epoxy grout, stain resistant, conforming to ANSI 118.3.
  - 1. Epoxy Grout shall be non-toxic, non-flammable, non-hazardous during storage, mixing, application and when cured and shall meet the following minimum physical requirements in compliance with ANSI A118.3 test methods:
    - a. Compressive Strength: greater than 3500 psi (24,131 kPa).

- b. Quarry Tile Shear Bond Strength: 1000 psi (24,131 kPa) min.
2. The finished Epoxy grout shall be chemically and stain resistant to catsup, mustard, tea, coffee, milk, soda, beer, wine, bleach (5% solution), ammonia, juices, vegetable oil, brine, sugar, cosmetics, and blood. It shall also be chemically resistant to dilute acids and alkalis, gasoline, turpentine, and mineral spirits.
3. Acceptable products are limited to:
  - a. Mapei product: "Kerapoxy" grout.
  - b. Laticrete product "SpectraLock Pro Premium". Series.
  - c. Custom Building Products, product "100% Solids Epoxy Gout".

## 2.7 ACCESSORIES

- A. Edge strips: Design as required for the condition of use, and fabricate from extruded aluminum, mill finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  1. Verify that all concrete substrates are at least 28 calendar days old, completely cured and free of negative hydrostatic conditions or moisture problems.
- B. Beginning of installation means acceptance of substrate and site conditions.

### 3.2 PREPARATION

- A. During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- B. Remove existing deteriorated and damaged tile. Remove non-matching previously patched tile.
  1. Carefully remove existing deteriorated and damaged tile without harming surrounding tiles. Prior to removing tiles, remove all existing grout surrounding tiles to be removed with a grout saw. For existing grout joints which are wider than 3/8 inch width contractor may utilize a dry-cutting diamond blade, mounted in an angle grinder or circular saw.
- C. Ensure that all anchors, plugs, electrical and mechanical work to be in or underneath tile have been installed.
- D. Vacuum clean substrate surfaces.
- E. Seal concrete substrate cracks with filler; level concrete substrate to acceptable flatness tolerances.

1. The use of PVA bonding agents or gypsum based leveling materials is prohibited.
- F. Apply conditioner or primer to surfaces as recommended by adhesive manufacturer.

### 3.3 INSTALLATION - GENERAL REQUIREMENTS

- A. Installation Standards: 2016 TCNA Handbook for Ceramic, Glass, and Stone Tile Installation and The American National Standard Specifications for the Installation of Ceramic Tile, 2017 edition (ANSI A108-A118-A136.1), is hereby made a part of this specification. All work of this Section shall be installed in accordance with the requirements contained in referenced standards, and as additionally specified below, and in accordance with the manufacturer's specifications of those products used.
- B. Installation Methods: Schedule of substrate conditions, generic type of tile used, with appropriate setting and grouting methods are listed at end of this Section.
1. Use trowel shapes and sizes as recommended by setting materials manufacturer.
  2. Clean porcelain tiles (backs) and remove manufacturer's residue.
  3. Back-butter tiles as required to provide coverage indicated, except for tiles exceeding 144 square inches which require a complete back application of mortar (100% coverage).
- C. Tile Patterns and types: Tile patterns are shown on the Drawings, if more information is required, obtain the necessary information from the Architect. Do not interrupt tile pattern around openings.
- D. Tile Layout and installation
1. Layout tile on room axis, leaving equal sized border units of not less than one-half tile width.
  2. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align base and wall joints.
  3. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, full without voids, cracks, excess mortar, or excess grout.
  4. Do not align joints of base units and lowest course of tile, offset joints by one-half of unit width.

### 3.4 INSTALLATION OF CEMENT BOARD

- A. Walls:
1. Wall framing substrate: Do not install cement board directly over protrusions from stud plane such as heavy brackets or fastener heads.
  2. Make necessary cut-outs. Install cement board horizontally leaving 1/8 to 3/16 space at all joints, including joints with dissimilar materials. Stagger board joints with those of adjacent rows.

3. Fasten cement board with 1-1/4 inch length type S bugle head screw. Fasten boards every 8 inches on center in field and along edges. At edge conditions, locate fasteners between 1/2 inch to 2 inches from board edge.
4. At all joints and corners, fill gap solidly with dry-set or latex-modified, portland cement mortar and imbed 2 inch mesh fiberglass table and smooth material over joint and corner.

### 3.5 INSTALLATION – METAL EDGE TRIM

- A. General: Apply materials in strict accordance with the written instructions and recommendations of edge material and setting materials manufacturers.
  1. Ensure that top surface of metal edge and transition strips align with surface plane of tile.
  2. Locations: Provide metal edge at every flooring transition between tile and other flooring materials.
- B. Press perforated anchoring leg of trim into troweled dry set mortar bedding. Trowel additional mortar over perforated anchoring leg of trim to ensure full coverage and support of tile edges.
- C. Solidly embed tiles in manner that tiled surface is flush with top of trim profile. Tile may exceed trim height by 1/32 inch [1 mm] to 1/16 inch [1.5 mm], but tile may not be installed lower than height of trim. Maintain a 1/8 inch [3 mm] minimum uniform joint width between edge of tile and metal trim to be filled by grout.

### 3.6 INSTALLATION OF CONTROL JOINTS

- A. General: Provide control joints where indicated on the Drawings, and as directed by the Architect. Where not indicated, provide joints per the following requirements in specific locations approved by Architect:
  1. Interior tilework: 24 to 36 feet in each direction, except where exposed to direct sunlight or moisture.
  2. Interior tilework exposed to direct sunlight or moisture: 12 to 16 feet in each direction.
  3. Where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, and where changes occur in substrate materials.
  4. At perimeter walls in rooms and spaces larger than 12 feet on one side.
  5. As continuation of expansion joints, control joints, and seismic joints in the building structure which occur in tile areas.
- B. Locations: Verify exact locations of joints with Architect prior to commencing tile installation.
- C. Control joints:
  1. Form control joints neat, straight, and uniformly wide equal to width of normal tile joint. Cut tile neatly and to accurate radius at exposed junction with pipes.
  2. Extend control joints full thickness of tile, setting bed and reinforcing.

- D. Keep open joints free of grout and debris until filled with sealant. Install non-contaminating temporary joint filler to maintain joints in clean condition until installation of joint backing and sealant under Section 07900 - JOINT SEALERS.

E.

### 3.7 INSTALLATION - TCNA NUMBER TR611 WITH STONE THRESHOLDS

- A. General: Install in accordance with ANSI A108.5, TCNA installation method number TR611, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
- B. Grouting: Install in accordance with installation requirements of abutting tile.

### 3.8 INSTALLATION – METAL EDGE AND TRANSITION STRIPS

- A. General: Install in accordance with ANSI A108.5, TCNA installation method number F113, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
- B. Grouting: Install in accordance with installation requirements of abutting tile.

### 3.9 INSTALLATION - GROUT

- A. Remove spacers, ropes, glue, and similar foreign matter prior to grouting.
- B. Force the maximum amount of the approved grout into joints in accordance with pertinent recommendations contained in ANSI A108.10 and for epoxy grouts, ANSI A108.6.
- C. Fill in joints of cushion-edge tile to depth of the cushion; fill joints of square-edge tile flush with the surface.
- D. Fill all gaps and skips. Do not permit mortar or mounting mesh to show through grouted joints.
- E. Provide hard finished grout which is uniform in color, smooth and without voids, pin holes, or low spots.
- F. Remove all excess grout immediately after installation thereof, wash and rinse tile free from grout film, and tool grout to a uniform density throughout.
- G. Apply grout joint sealer in accordance with manufacturer's instructions.

### 3.10 REPAIR

- A. Replace cracked chipped, broken, and otherwise defective tiles.
- B. Remove work not complying with requirements of the Contract Documents or the referenced standards, and promptly replace with work which does comply.

3.11 CLEANING

- A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of mortar, grout, and other materials installed under this Section, and wash completed tilework.
  - 1. Do not use acid or acid cleaners to clean tile.
  - 2. When tile is thoroughly clean and dry, polish glazed tile with clean dry cloths.

3.12 CURING

- A. Cover with clean non-staining 40 pound kraft paper. Do not use polyethylene sheets directly over tile on horizontal surfaces.

3.13 PROTECTION

- A. Do not permit traffic over finished floor surface until grout and tile materials are fully set, and not less than 72 hours. Protect floor surfaces with heavy red-rosin paper or kraft paper.

End of Section



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Section 09 30 33  
STONE TILING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Engineered Stone Floor Tile (designated TZ-1).
  - 2. Fluid applied waterproofing membrane at wet floor areas occurring over occupied spaces and where additionally indicated.
  - 3. Anti-fracture membrane at slab on grade conditions and "dry" flooring areas.
  - 4. Installation systems, adhesives, mortars and grouts.
  - 5. Control joints in tiled floors.
- B. Perform drilling and cutting in tile surfaces, as required to accommodate penetrating items of other trades, from templates and instructions furnished by the respective trades.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete slab substrate.
- D. Section 07 92 00 - JOINT SEALANTS: Backer rod and sealant at control joints.
- E. Division 22 - PLUMBING: Floor drains.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. . Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. .
  - 1. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.

2. ANSI A108.6 - Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.
  3. ANSI A108.9 - Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.
  4. ANSI A108.10 - Installation of Grout in Tilework.
  5. ANSI A108.11 - Interior Installation of Cementitious Backer Units.
  6. ANSI A118.1 - Dry-Set Portland Cement Mortar.
  7. ANSI A118.3 - Chemical-Resistant, Water-Cleanable, Tile Setting and Grouting Epoxy and Water-Cleanable Tile Setting Epoxy Adhesive.
  8. ANSI A118.4 - Latex-Portland Cement Mortar.
  9. ANSI A118.6 - Ceramic Tile Grouts.
  10. ANSI A118.7 – Polymer Modified Cement Grouts
  11. ANSI A118.8 - Modified Epoxy Emulsion Mortar/Grout.
  12. ANSI A118.9 - Cementitious Backer Units.
  13. ANSI A118.10 - Waterproofing.
  14. ANSI A137.1 - Specifications for Ceramic Tile.
  15. ANSI A10.20 - Safety Requirements for Ceramic Tile, Terrazzo and Marble Work.
  16. ASTM C 627 - Evaluating Ceramic Floor Tile Installation Systems.
  17. ASTM C 920 - Specifications for Elastomeric Joint Sealant.
  18. ASTM E 119 – Fire Test of Building Construction and Materials.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. TCNA (formerly TCA) - Handbook for Ceramic Tile Installation, latest edition.
- C. Definitions: For the purposes of these specifications the following terms are defined:
1. Wet Areas: Rooms/spaces which has plumbing fixtures, sinks, toilets, or floor drains. Wet areas additionally include rooms/spaces which are exposed to weather.
  2. Dry Areas: Rooms/spaces which have no plumbing, sinks, toilets, or floor drains.

## 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-installation meetings:
1. At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

- a. Required attendees: Architect, General Contractor, Tile Installer's Project Superintendent, Tile setting materials manufacturer's technical representative and representatives for installers of related work specified under the following Sections:
  - 1) Section 09 29 00 – GYPSUM BOARD.
- b. Agenda:
  - 1) Scheduling of tiling operations.
  - 2) Review of setting methods and materials required.
  - 3) Review of staging and material storage locations.
  - 4) Coordination of work by other trades.
  - 5) Protection of completed tile work.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
    - a. Include maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
  2. Shop Drawings: 1/4 inch scale elevations and plans of tile patterns.
  3. Selection Samples:
    - a. Manufacturer's sample boards for each type and color group of tile specified, and grout colors, for selections by the Architect.
  4. Verification Samples:
    - a. Mount tile and apply grout on one 24 by 24 inch cement backerboard board, for each tile type and selected color, to indicate color and texture variations, tile flatness and joint size variations.
    - b. Trim shapes and base, in selected colors in types and shapes indicated for project conditions.
    - c. Stone threshold, 12 inch long samples in shaped profile.
  5. Source Quality Control Submittals:
    - a. Grade Certificates: Manufacturer's Master Grade Certificates submitted prior to shipment of tile to project.
      - 1) Comply with ANSI A137.1 for special purpose tiles.
  6. LEED Submittal Requirements:
    - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
      - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
        - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
        - b) EPD shall have at least Cradle to Gate scope,
      - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.

- b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
  - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
    - a) Itemized vendor invoices for FSC-certified products.
    - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
  - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
- c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
  - 1) Recycled Content:
    - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
    - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
  - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
    - a) Documentation should be in the form of one of the following:
    - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
    - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
    - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
    - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
    - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
  - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.

- 
- b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:
    - 0.5 mg/m<sup>3</sup> or less;
    - Between 0.5 and 5.0 mg/m<sup>3</sup>; or
    - 5.0 mg/m<sup>3</sup> or more
  - c) Laboratory accreditation under ISO/IEC 17025.
  - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
- 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:
      - 0.5 mg/m<sup>3</sup> or less;
      - Between 0.5 and 5.0 mg/m<sup>3</sup>; or
      - 5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.
- f. Indoor Environmental Quality Credit 3: Low-Emitting Materials (flooring systems):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:
      - 0.5 mg/m<sup>3</sup> or less;
      - Between 0.5 and 5.0 mg/m<sup>3</sup>; or
      - 5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area

- 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for flooring systems installed within the waterproofing membrane.

- B. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
  1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra materials in, an amount equal to 3 percent of tile and trim of each color, finish and type installed.

#### 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
  1. Conform to ANSI/TCNA A 137.1 and TCNA Handbook for Ceramic Tile Installation.
  2. Tiles delivered to the job or installed in the work which do not fall within the accepted color and texture range demonstrated by the samples shall be removed from the site and replace with acceptable materials.
- B. Sole Source: Obtain installation products required for the Work of this Section from a single manufacturer.
- C. Qualifications:
  1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

#### 1.8 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Provide mock-up panels, minimum 160 square feet, illustrating color, texture and finish, and demonstrating the minimum standard for the Work.
  1. Mock-up will demonstrate quality of work, construction methods, color and texture of tile, flatness of installation, joint spacing and color of grout. Include typical tile accessories and a control joint.
  2. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
  3. Accepted mock-ups may not remain as part of the work; the number of mock-ups shall not be restricted.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  2. Deliver tile in manufacturer's sealed cartons, grade-sealed by the manufacturer in accordance with ANSI A 137.1, with grade-sealed unbroken, and clearly marked as to contents, color, and quantity.

3. Deliver and store tile setting materials in original, sealed, containers showing manufacturer's identification, year of production, new weight, date of packaging, and location of packaging.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  2. Store waxed tile in manner keeping wax off the sides and backs of the units.
  3. Store and protect containers above floor level, keep dry until ready for use.
  4. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions. Store epoxy mortar and epoxy grouts at 70 degrees Fahrenheit (21° C) temperature for 24 hours prior to use.

#### 1.10 SITE CONDITIONS

- A. Environmental conditions:
1. General: Maintain ambient temperatures between 50 (10° C) and 80 (26° C) degrees Fahrenheit in tiled areas, for 24 hours prior to installation, during installation and for 7 days after completion.
  2. Special environmental conditions for epoxy setting and grout materials: Maintain ambient temperatures between 65 degrees Fahrenheit (18° C) and 80 degrees Fahrenheit (27° C) in tiled areas, for 24 hours prior to installation, during installation and for 7 days after completion.
  3. When temperature of substrate exceeds 90 (32° C) degrees Fahrenheit, contact manufacturer for instructions.
- B. Do not install setting or grouting materials in a closed, unventilated environment. Ventilate propane or fossil fuel heaters to prevent damage to tile work from carbon-dioxide build up.
- C. Shade work areas in direct sunlight during installation to prevent rapid evaporation caused by excessive heat.

#### 1.11 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manufacturer Warranty: The manufacturer of installation systems, adhesives, grouts and mortars shall provide a comprehensive non pro-rated written five (5) year warrantee against defective products which covers replacement materials and labor costs for demolition, tile accessories, and installation systems.
1. Warranty to provide for tile lifting or separation from substrate, and setting bed/grout deterioration, when products have been installed with referenced TCNA setting systems using specified setting and grout materials.
  2. Warranty excludes structural failure, movement or cracking of substrate materials, and workmanship performed not in accordance with manufacturer's instructions and industry standard guidelines.
- C. Special Warranty: Provide 2 year, non pro-rated warranty which shall include provisions for cracking, breakage or failure of tile due to defective workmanship



1. Materials must be compatible and from one source, single source responsibility for waterproofing, installation, mortars and grouts. Job-site mixtures of sand portland cement and site dilution of additives shall not be permitted.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following or approved equal:
  1. Engineered Stone tile:
    - a. Stone Source (local rep.: 311 Summer Street, Boston, MA 02210).
  2. Mortars, adhesives & Grouts:
    - a. Custom Building Products, Inc., Seal Beach, CA.
    - b. Laticrete International, Inc., Bethany CT
    - c. Mapei Corporation, Elk Grove IL.
  3. Cementitious tile backer board ("Cement board"):
    - a. Custom Building Products, Inc., Seal Beach, CA.
    - b. Fin Pan, Inc., Hamilton OH.
    - c. Unifix, Inc., division of National Gypsum Company, Charlotte, NC.
    - d. United States Gypsum Company, Chicago, IL.
  4. Edging materials:
    - a. Schlüter Systems L.P., Plattsburgh NY.
    - b. Custom Building Products, Inc., Seal Beach, CA.
    - c. Ceramic Tool Company Inc., Waukesha WI.

### 2.2 ENGINEERED STONE FLOOR

- A. Engineered Stone Tile TZ-1: Stone Source, collection "Trend Terrazzo Origina", product "Terr Chiara" number 1607, nominal 12 by 24 inches by 6.6mm thickness, having polished finish.
  1. Availability Information: This is a long lead item requiring special order. Contractor to schedule accordingly to prevent delays in the work.

### 2.3 SETTING MATERIALS

- A. Thin-set polymer-modified Portland cement dry-set mortar, complying with the bond strength requirements of ANSI A118.4.
  1. Acceptable products are limited to:
    - a. Mapei product: "Kerabond" with "Keralastic" additive.
    - b. Laticrete product number 254 Platinum.
    - c. Custom Building Products "Porcelain Tile Mortar"
- B. Fluid applied waterproofing membrane: ASTM C627 classification "Extra Heavy". Two component liquid rubber membrane cold applied, load bearing, bonded, non-

toxic, non-flammable, and non-hazardous, used with 20 mil (0.5mm) thick flexible nonwoven rot-proof polyvinyl chloride reinforcing fabric.

1. Waterproofing membrane shall be IAPMO certified as shower pan liner under the International Plumbing Code.
  2. Waterproofing membrane shall provide crack suppression and isolation for anti-fracture per ANSI A118.12.5.4, spanning 1/8 inch (3mm) crack, and meet the following physical requirements:
    - a. Water Permeability (at 30ft.hydro/0.9 atmos/91.2kPa): Nil.
    - b. Elongation at break (ASTM D-751): 20 to 30%
    - c. Service Temperatures: -20° to +280°F. (-29°to +138°C).
    - d. Tensile breaking strength: 2950psi (20.4MPa;207kg/cm<sup>2</sup>)
    - e. Bond strength to concrete: 350psi (2.4MPa;24kg/cm<sup>2</sup>)
    - f. Resistance to chemicals (90 day immersion):
      - 1) Brine solution Not Affected.
      - 2) Sugar solution Not Affected.
      - 3) Milk Not Affected.
      - 4) 10% Citric Acid Not Affected.
      - 5) 3.5 percent HCl Acid: Not affected.
      - 6) 5% Acetic Acid: Not Affected
      - 7) 1% Alkali solution: Not Affected
      - 8) Urine: Not Affected
      - 9) Calcium chloride: Not Affected.
      - 10) Toluol Softens.
    - g. Floor Tile Installation Evaluation (ASTM C627-81) 900 cycles
    - h. Service Rating (TCNA) Extra Heavy Duty
  3. Acceptable products are limited to:
    - a. Mapei product: "Mapelastic 315" with fabric reinforcing.
    - b. Laticrete product "Laticrete 9235 Waterproofing" with fabric reinforcing.
    - c. Custom Building Products "9240 Waterproofing".
- C. Anti-fracture membrane for crack suppression and substrate crack isolation. Two component system (liquid and fabric) complying with TCNA performance level: Extra Heavy Service".
1. Acceptable products are limited to:
    - a. Mapei product: "Plani/Lastic".
    - b. Laticrete product "Blue 92".
    - c. Custom Building Products "Crack Buster Pro" or "Fracture Free".

## 2.4 GROUTING MATERIALS

- A. Epoxy grout: Multi-component epoxy grout, stain resistant, conforming to ANSI 118.3.
1. Epoxy Grout shall be non-toxic, non-flammable, non-hazardous during storage, mixing, application and when cured and shall meet the following

minimum physical requirements in compliance with ANSI A118.3 test methods:

- a. Compressive Strength: greater than 3500 psi (24,131 kPa).
  - b. Quarry Tile Shear Bond Strength: 1000 psi (24,131 kPa) min.
2. The finished Epoxy grout shall be chemically and stain resistant to catsup, mustard, tea, coffee, milk, soda, beer, wine, bleach (5% solution), ammonia, juices, vegetable oil, brine, sugar, cosmetics, and blood. It shall also be chemically resistant to dilute acids and alkalis, gasoline, turpentine, and mineral spirits.
  3. Acceptable products are limited to:
    - a. Mapei product: "Kerapoxy" grout.
    - b. Laticrete product "SpectraLock Pro Premium". Series.
    - c. Custom Building Products, product "100% Solids Epoxy Gout".

## 2.5 ACCESSORIES

- A. Edge strips: Design as required for the condition of use, and fabricate from extruded aluminum, mill finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  1. Verify that all concrete substrates are at least 28 calendar days old, completely cured and free of negative hydrostatic conditions or moisture problems.
- B. Beginning of installation means acceptance of substrate and site conditions.

### 3.2 PREPARATION

- A. During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- B. Remove existing deteriorated and damaged tile. Remove non-matching previously patched tile.
  1. Carefully remove existing deteriorated and damaged tile without harming surrounding tiles. Prior to removing tiles, remove all existing grout surrounding tiles to be removed with a grout saw. For existing grout joints which are wider than 3/8 inch width contractor may utilize a dry-cutting diamond blade, mounted in an angle grinder or circular saw.
- C. Ensure that all anchors, plugs, electrical and mechanical work to be in or underneath tile have been installed.

- D. Vacuum clean substrate surfaces.
- E. Seal concrete substrate cracks with filler; level concrete substrate to acceptable flatness tolerances.
  - 1. The use of PVA bonding agents or gypsum based leveling materials is prohibited.
- F. Apply conditioner or primer to surfaces as recommended by adhesive manufacturer.

### 3.3 INSTALLATION - GENERAL REQUIREMENTS

- A. Installation Standards: 2016 TCNA Handbook for Ceramic, Glass, and Stone Tile Installation and The American National Standard Specifications for the Installation of Ceramic Tile, 2017 edition (ANSI A108-A118-A136.1), is hereby made a part of this specification. All work of this Section shall be installed in accordance with the requirements contained in referenced standards, and as additionally specified below, and in accordance with the manufacturer's specifications of those products used.
- B. Installation Methods: Schedule of substrate conditions, generic type of tile used, with appropriate setting and grouting methods are listed at end of this Section.
  - 1. Use trowel shapes and sizes as recommended by setting materials manufacturer.
  - 2. Back-butter tiles as required to provide coverage indicated, except for tiles exceeding 144 square inches which require a complete back application of mortar (100% coverage).
- C. Floor Patterns and types: Tile patterns are shown on the Drawings, if more information is required, obtain the necessary information from the Architect. Do not interrupt tile pattern around openings.
- D. Tile Layout and installation
  - 1. Layout tile on room axis, leaving equal sized border units of not less than one-half tile width.
  - 2. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align base and wall joints.
  - 3. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, full without voids, cracks, excess mortar, or excess grout.
  - 4. Do not align joints of base units and lowest course of tile, offset joints by one-half of unit width.

### 3.4 INSTALLATION – METAL EDGE TRIM

- A. General: Apply materials in strict accordance with the written instructions and recommendations of edge material and setting materials manufacturers.
  - 1. Ensure that top surface of metal edge and transition strips align with surface plane of tile.
  - 2. Locations: Provide metal edge at every flooring transition between tile and other flooring materials.

- B. Press perforated anchoring leg of trim into troweled dry set mortar bedding. Trowel additional mortar over perforated anchoring leg of trim to ensure full coverage and support of tile edges.
- C. Solidly embed tiles in manner that tiled surface is flush with top of trim profile. Tile may exceed trim height by 1/32 inch [1 mm] to 1/16 inch [1.5 mm], but tile may not be installed lower than height of trim. Maintain a 1/8 inch [3 mm] minimum uniform joint width between edge of tile and metal trim to be filled by grout.

### 3.5 INSTALLATION OF CONTROL JOINTS

- A. General: Provide control joints where indicated on the Drawings, and as directed by the Architect. Where not indicated, provide joints per the following requirements in specific locations approved by Architect:
  - 1. Interior tilework: 24 to 36 feet in each direction, except where exposed to direct sunlight or moisture.
  - 2. Interior tilework exposed to direct sunlight or moisture: 12 to 16 feet in each direction.
  - 3. Where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, and where changes occur in substrate materials.
  - 4. At perimeter walls in rooms and spaces larger than 12 feet on one side.
  - 5. As continuation of expansion joints, control joints, and seismic joints in the building structure which occur in tile areas.
- B. Locations: Verify exact locations of joints with Architect prior to commencing tile installation.
- C. Control joints:
  - 1. Form control joints neat, straight, and uniformly wide equal to width of normal tile joint. Cut tile neatly and to accurate radius at exposed junction with pipes.
  - 2. Extend control joints full thickness of tile, setting bed and reinforcing.
- D. Keep open joints free of grout and debris until filled with sealant. Install non-contaminating temporary joint filler to maintain joints in clean condition until installation of joint backing and sealant under Section 07900 - JOINT SEALERS.

### 3.6 INSTALLATION – METAL EDGE AND TRANSITION STRIPS

- A. General: Install in accordance with ANSI A108.5, TCNA installation method number F113, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
- B. Grouting: Install in accordance with installation requirements of abutting tile.

### 3.7 INSTALLATION - GROUT

- A. Remove spacers, ropes, glue, and similar foreign matter prior to grouting.

- B. Force the maximum amount of the approved grout into joints in accordance with pertinent recommendations contained in ANSI A108.10 and for epoxy grouts, ANSI A108.6.
- C. Fill in joints of cushion-edge tile to depth of the cushion; fill joints of square-edge tile flush with the surface.
- D. Fill all gaps and skips. Do not permit mortar or mounting mesh to show through grouted joints.
- E. Provide hard finished grout which is uniform in color, smooth and without voids, pin holes, or low spots.
- F. Remove all excess grout immediately after installation thereof, wash and rinse tile free from grout film, and tool grout to a uniform density throughout.
- G. Apply grout joint sealer in accordance with manufacturer's instructions.

### 3.8 REPAIR

- A. Replace cracked chipped, broken, and otherwise defective tiles.
- B. Remove work not complying with requirements of the Contract Documents or the referenced standards, and promptly replace with work which does comply.

### 3.9 CLEANING

- A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of mortar, grout, and other materials installed under this Section, and wash completed tilework.
  - 1. Do not use acid or acid cleaners to clean tile.
  - 2. When tile is thoroughly clean and dry, polish glazed tile with clean dry cloths.

### 3.10 CURING

- A. Cover with clean non-staining 40 pound kraft paper. Do not use polyethylene sheets directly over tile on horizontal surfaces.

### 3.11 PROTECTION

- A. Do not permit traffic over finished floor surface until grout and tile materials are fully set, and not less than 72 hours. Protect floor surfaces with heavy red-rosin paper or kraft paper.

End of Section

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Section 09 51 00  
ACOUSTICAL CEILINGS

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Suspended acoustical tile ceiling including suspension system and associated edge moldings.
- B. Install the following furnished under the designated Sections:
  - 1. Access panels occurring in acoustical ceilings furnished by Section 08 31 00 - ACCESS PANELS AND DOORS, or by section requiring the same.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION: Demolition of work abutting existing ceilings and demolition of existing ceilings for new construction.
- D. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
- E. Section 09 22 16 – NON-STRUCTURAL METAL FRAMING: Metal ceiling and soffit framing for gypsum board, including hanger attachments, wire hangers, and screwable metal tee grid system.
- F. Section 09 29 00 - GYPSUM BOARD: Suspended drywall construction ceilings and soffits.
- G. Section 07 92 00 – JOINT SEALANTS: Sealant at gaps between new acoustical ceiling edge angles and all irregular walls.
- H. Division 21 – FIRE PROTECTION: Sprinkler heads in ceiling system.
- I. Division 23 - MECHANICAL: Air diffusion devices in ceiling.
- J. Division 26 - ELECTRICAL:



1. Fire alarm and smoke detection equipment mounted in ceiling system.
2. Light fixtures and independent hangers for suspended fixtures.

#### 1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. ASTM A 641 - Zinc-Coated (Galvanized) Carbon Steel Wire
1. ASTM C423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method "UL Classified".
  2. ASTM C523 - Light reflectance of Acoustical Material by the Integrating Sphere Reflectometer.
  3. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
  4. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
  5. ASTM E84 - Surface Burning Characteristics of Building Material "UL Classified"
  6. ASTM E119 - Fire Tests of Building Construction and Materials "UL Classified".
  7. ASTM E413 - Classification for Rating Sound Insulation.
  8. ASTM E580 - Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
  9. ASTM E1264 - Classification of Acoustical Ceiling Products.
  10. ASTM E1414 - Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum. "UL Classified".
  11. UL Fire Resistance Directory and Building Material Directory.
  12. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.
- B. General References The following reference materials are hereby made a part of this Section by reference thereto:
1. CISCA (Ceilings and Interior Systems Contractors Association) - Acoustical Ceilings: Use and Practice.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Architect, General Contractor, Installer's Project Superintendent, manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work.
  2. Agenda:
    - a. Scheduling of acoustical ceiling operations.
    - b. Review of staging and material storage locations.
    - c. Coordination of work by other trades.
    - d. Installation procedures for ancillary equipment.
    - e. Protection of completed Work.
    - f. Establish weather and working temperature conditions to which Architect and Contractor must agree.
    - g. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.
- C. Sequencing:
1. Field Measurements
    - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
    - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
  2. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, to allow work which will be concealed by the ceilings to be completed prior to commencing installing the ceilings in such locations.
- D. Scheduling:
1. Install acoustical units after interior wet work is dry.
  2. Schedule 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.
- 1.6 SUBMITTALS
- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
  2. Shop Drawings:
    - a. 1/4 inch scale plans of each room or space; indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to the system.
    - b. All drawings bearing dimensions of actual measurements taken at the project.
    - c. Large scale installation details of special conditions.
  3. Verification Samples:

- a. 12 by 12 inch samples of acoustical units, illustrating material and finish.
  - b. 12 inch long samples of suspension system components including main runners, cross runner and edge trim.
4. LEED Submittal Requirements:
- a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
    - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
      - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
      - b) EPD shall have at least Cradle to Gate scope,
    - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
    - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
      - a) Itemized vendor invoices for FSC-certified products.
      - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
    - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
  - c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
    - 1) Recycled Content:
      - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
      - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
    - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
      - a) Documentation should be in the form of one of the following:
      - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
      - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.

- 
- d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
  - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
  - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
- 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (ceilings):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:
      - 0.5 mg/m<sup>3</sup> or less;
      - Between 0.5 and 5.0 mg/m<sup>3</sup>; or
      - 5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for ceilings, walls, thermal and acoustical insulation products installed within the waterproofing membrane.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- 1. Bonds and Warranty Documentation:
    - a. Manufacturer's Warranties and guarantees as specified elsewhere herein this Section.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
- 1. Provide to the Owner, extra ceiling panels: 3 percent of each type installed.
  - 2. Provide to the Owner, extra suspension components: 3 percent of each type installed.
  - 3. Provide to the Owner, all extra salvaged ceiling panel and suspension components which have not been utilized in the Work.
- 1.7 QUALITY ASSURANCE
- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
  - B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of acoustical ceiling panels.

1.8 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Locate mock-ups where directed and include all surfaces and materials scheduled to receive a field applied finish.
- C. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
- D. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  - 2. Do not deliver acoustical ceiling panels to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
  - 3. Deliver acoustical ceiling panels in original, unopened packages and store protected in a fully enclosed space.
- B. Storage and Handling Requirements:
  - 1. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Packaging Waste Management:
- D. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.10 SITE CONDITIONS

- A. Maintain uniform temperature of minimum of 60 degrees Fahrenheit and humidity of 20 to 40 percent prior to, during, and after installation.

1.11 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manufacturer Warranty:
  - 1. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities

which the Contractor may have by law or other provisions of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Acoustical ceiling panel:
    - a. Armstrong World Industries, Inc., Lancaster PA.
    - b. USG Interiors Inc., Chicago IL.
    - c. Certainteed Corporation, Valley Forge, PA.
  2. Suspension system:
    - a. Armstrong World Industries, Inc., Lancaster PA.
    - b. USG Interiors Inc., (Donn®) Chicago IL.
    - c. Chicago Metallic Corp., Chicago IL.

### 2.2 DESCRIPTION

- A. General Description: Manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance as indicated.
- B. Sustainability Requirements:
1. Recycled content of acoustical ceiling panels: Use maximum available percentage of materials by weight. Products incorporated into the work shall contain not less than 50 percent of recycled content.
  2. Recycled content of steel used in grid framing: Use maximum available percentage of recycled steel. Steel framing products incorporated into the work shall contain not less than 25 percent of recycled steel.

### 2.3 ACOUSTICAL CEILING PANELS

- A. Type ACT-1 Ceiling panel:
1. Panel size: 24 by 48 inch by 1 inch thick.
  2. Panel edge: Tegular edge.
  3. Description: ASTM E1264 Type XII, Form 2, Pattern E or G, Class A flame spread, wet formed mineral fiber, non-directional fissured, medium textured panel, non-combustible, vinyl latex paint finish.
  4. Color: White.
  5. Minimum light reflectance (LR): 0.88 percent.
  6. Acoustical characteristics:
    - a. NRC: 0.95.
    - b. AC: 190.
  7. Acceptable products:

- a. Armstrong product "Optima Tegular" product number 3250.
  - b. Certainteed product "Ecophon Gedina E" product number 3539 4426.
  - c. USG product "Halcyon Climaplus" with FL edge, product number 98223.
- B. Type ACT-2 Ceiling panel:
1. Panel size: 24 by 48 inch by 5/8 inch thick.
  2. Panel edge: Square edge.
  3. Description: ASTM E-1264 Type IV Form 2, Pattern E, or Type X, Pattern GI UL Fire Resistance Labeled, wet formed mineral, fiber non-directional non-perforated impervious white vinyl faced panel, non-combustible.
  4. Color: White.  
Minimum light reflectance (LR): 0.80.
  5. Acoustical characteristics:
    - a. CAC range: 40.
  6. Acceptable products:
    - a. Armstrong product "Clean Room VL Unperforated" product number 870.
- C. Type ACT-3 Ceiling panel:
1. Panel size: 24 by 24 inch by 3/4 inch thick.
  2. Panel edge: Flush-Tegular edge.
  3. Description: ASTM E-1264 Type III, Form 2, Pattern JZ, Class A flame spread, wet formed mineral fiber, having pressed pattern, non-combustible, vinyl latex paint finish.
  4. Color: White.
  5. Minimum light reflectance (LR): 0.80
  6. Acoustical characteristics:
    - a. CAC: 35.
  7. Acceptable products:
    - a. Armstrong product "Ledges II" product number 8013.
- D. Type ACT-4 Ceiling panel:
1. Panel size: 24 by 24 inch by 3/4 inch thick.
  2. Panel edge: Flush-Tegular edge.
  3. Description: ASTM E-1264 Type III, Form 2, Pattern JZ, Class A flame spread, wet formed mineral fiber, having pressed pattern, non-combustible, vinyl latex paint finish.
  4. Color: White.
  5. Minimum light reflectance (LR): 0.80
  6. Acoustical characteristics:
    - a. CAC: 35.
  7. Acceptable products:
    - a. Armstrong product "Ledges II" product number 8013.

## 2.4 CEILING GRIDS

- A. Type ACT-1 Ceiling grid: 15/16 inch exposed tee grid in white color matching ceiling panel or black for ACT-4; acceptable products are:
  - 1. Armstrong; 15/16" Prelude XL .
- B. Type ACT-2 Ceiling grid: 15/16 inch exposed grid, aluminum capped prefinished steel tee suspension system (or all aluminum tee system), in white color matching ceiling tile. Provide with matching hemmed edge wall moldings having aluminum capping or all aluminum edge trim. Exposed face color shall be white matching ceiling tile. Acceptable products are:
  - 1. Armstrong: AL Prelude Plus Exposed Tee System
- C. Type ACT-3 Ceiling grid: 9/16 inch exposed tee grid in color matching ceiling panel, furnished with hemmed edge wall molding; acceptable products are:
  - 1. Armstrong; 9/16" Suprafine Exposed Tee Grid.
- D. Type ACT-4 Ceiling grid: 9/16 inch exposed tee grid in color matching ceiling panel, furnished with hemmed edge wall molding; acceptable products are:
  - 1. Armstrong; 9/16" Interlude XL Exposed Tee Grid.

## 2.5 ACCESSORIES

- A. Edge moldings: Standard edge trim: Grid system manufacturer's standard L-shape edge trim compatible with exposed grid system and color matched.
  - 1. Armstrong: Model 7800.
  - 2. Chicago Metallic: Model 1430.
  - 3. USG: Model M7.
- B. Edge/wall moldings where ceiling abuts walls and drop down soffits: Stepped profile "shadow" molding compatible with exposed grid system and color matched
  - 1. Armstrong: Model 7873.
  - 2. Chicago Metallic: Model 1460.
  - 3. USG: Model MS174.
- C. Hanger attachments: Of the most appropriate types for the specific receiving surfaces.
- D. Hangers: ASTM A641 Soft temper, pre-stretched galvanized carbon steel wire, with a yield stress of at least 3 times design load, but not less than 12 gage.
- E. Retention clips (ACT-2):
  - 1. Armstrong product number "0414,"
  - 2. Chicago metallic product number "935"
  - 3. USG product number "20428."



### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Beginning of installation means acceptance of existing substrate and project conditions.

#### 3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- B. Surface Preparation:
  - 1. Carefully examine all receiving surfaces, to which attachments will be made hereunder, and determine the most practical way of making such attachments. Request Architect's approval of any attachment method which differs from that indicated on the approved shop drawings before proceeding with installation.
  - 2. Permit acoustical ceiling tile to reach room temperature and a stabilized moisture content prior to installation.

#### 3.3 INSTALLATION

- A. Comply with requirements of ASTM E580-R84 to meet State seismic requirements for bracing the ceiling suspension system.
- B. Comply with recommendations for "Direct Hung Acoustical Tile and Lay-In Panel Ceilings for Seismic Zones 0-2" as published by Ceilings & Interior Systems Construction Association, Skokie IL.
- C. Locate system on room axis, leaving equal sized border units of not less than one-half tile width.
- D. Install all components of the suspended grid systems in accordance with the manufacturer's instructions, the approved shop drawings, conforming to ASTM C-636 requirements. Ensure a deflection not to exceed 1/360 span of 48-inch simple span.
- E. Install specified edge moldings wherever ceilings intersect a wall or partition surface, and around all items having any dimension of 4 inches or more which penetrate the ceilings, including circular penetrations. Set moldings absolutely level, using as long lengths as practicable, and secure with fasteners recommended by manufacturer for the type of substrate.
  - 1. Sealant Bed: Apply continuous ribbon of acoustical sealant (type AA specified under Section 07 92 00), concealed on back of vertical leg before installing moldings.

2. Screw-attach moldings to substrate at intervals not over 16 inches on center, and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.
- F. Install hanger attachments to overhead construction in accordance with the approved shop drawings, spacing the attachments not more than 48 inches on centers over location of each main tee member.
1. Aluminum Suspension Systems: Provide hangers spaced not more than 30 inches on center in each direction and not more than 8 inches from ends
  2. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers to span the extra distance.
  3. Install hanger wire to attachments with triple twists.
- G. Install main tees parallel to the long dimension of each area, spacing the tees 48 inches on centers. Secure the bottom of hanger wires through slots in the main tee members and tie with triple twists. Level the main tees as the work progresses.
- H. Lateral bracing:
1. Provide lateral bracing as required by applicable codes and regulations.
  2. Secure lateral bracing to structural members as detailed on the Drawings.
- I. Uniformly space the cross tees at 24 inches on centers, and secure the cross tees into the main tees as recommended by the system manufacturer.
- J. Fit acoustical ceiling tile units in place, free from damaged edges or other defects detrimental to appearance and function. Install acoustical ceiling tile level, in uniform plane, and free from twist, warp or dents.
1. Field cut tegular type tile with a tegular reveal at all edge conditions.
  2. Where required by governmental agencies having jurisdiction, install retention clips, provide two clips per ceiling panel installed on opposite sides of panel.
- 3.4 TOLERANCES
- A. Maximum variation from flat and level surface: 1/8 inch in 10 feet.
- B. Maximum variation from plumb of grid members caused by eccentric loads: 2 degrees.
- 3.5 CLEANING
- A. Properly clean surfaces of panels and open grids free from dirt and handling marks. Wherever surfaces cannot be cleaned by normal methods or have defects, remove and replace with new components.
- B. Clean work under provisions of Section 01 73 00 – EXECUTION.
- 3.6 PROTECTION
- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

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Section 09 58 13  
MONOLITHIC ACOUSTICAL CEILING SYSTEM

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Suspended monolithic acoustical ceiling including suspension system and associated edge moldings. (Designated CLG-1).

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 07 92 00 – JOINT SEALANTS: Sealant at gaps between acoustical ceiling system and all irregular walls.
- D. Section 09 22 16 – NON-STRUCTURAL METAL FRAMING: Metal ceiling and soffit framing for gypsum board, including hanger attachments, wire hangers, and screwable metal tee grid system.
- E. Section 09 29 00 - GYPSUM BOARD: Suspended drywall construction ceilings and soffits.
- F. Division 21 – FIRE PROTECTION: Sprinkler heads in ceiling system.
- G. Division 23 - MECHANICAL: Air diffusion devices in ceiling.
- H. Division 26 - ELECTRICAL:
  - 1. Fire alarm and smoke detection equipment mounted in ceiling system.
  - 2. Light fixtures and independent hangers for suspended fixtures.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 4200 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ASTM A 641 - Zinc- Coated (Galvanized) Carbon Steel Wire
  2. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method "UL Classified".
  3. ASTM C 523 - Light reflectance of Acoustical Material by the Integrating Sphere Reflectometer.
  4. ASTM C 635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
  5. ASTM C 636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
  6. ASTM E 84 - Surface Burning Characteristics of Building Material "UL Classified"
  7. ASTM E 119 - Fire Tests of Building Construction and Materials "UL Classified".
  8. ASTM E 413 - Classification for Rating Sound Insulation.
  9. ASTM E 580 - Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
  10. ASTM E 1264 - Classification of Acoustical Ceiling Products.
  11. ASTM E 1414 - Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum. "UL Classified".
  12. UL Fire Resistance Directory and Building Material Directory.
  13. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.
- B. General References The following reference materials are hereby made a part of this Section by reference thereto:
1. CISCA (Ceilings and Interior Systems Contractors Association) - Acoustical Ceilings: Use and Practice.

## 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing:
1. Field Measurements
    - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
    - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
  2. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, to allow work which will be concealed by the ceilings to be completed prior to commencing installing the ceilings in such locations.
- C. Scheduling:

1. Install acoustical units after interior wet work is dry.
2. Schedule 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.

#### 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 3300 - SUBMITTAL PROCEDURES:
  1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
  2. Shop Drawings:
    - a. 1/4 inch scale plans of each room or space; indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to the system.
    - b. All drawings bearing dimensions of actual measurements taken at the project.
    - c. Large scale installation details of special conditions.
  3. Verification Samples:
    - a. 12 by 12 inch samples of acoustical units finish, illustrating material and finish.
    - b. 12 inch long samples of suspension system components including main runners, cross runner and edge trim.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
  1. Bonds and Warranty Documentation:
    - a. Manufacturer's Warranties and guarantees as specified elsewhere herein this Section.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
  1. Provide to the Owner, extra ceiling panels: 3 percent of each type installed.
  2. Provide to the Owner, extra suspension components: 3 percent of each type installed.

#### 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of acoustical ceiling panels.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  2. Do not deliver acoustical ceiling panels to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
  3. Deliver acoustical ceiling panels in original, unopened packages and store protected in a fully enclosed space.
- B. Storage and Handling Requirements:
1. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Packaging Waste Management:
- D. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.
- 1.9 SITE CONDITIONS
- A. Maintain uniform temperature of minimum of 60 degrees Fahrenheit and humidity of 20 to 40 percent prior to, during, and after installation.
- 1.10 WARRANTY
- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manufacturer Warranty: In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on USG Interiors Inc., Chicago IL., product "Ensemble", designated on Drawings as CLG-1, refer to Drawing A801 – ROOM FINISH SCHEDULE.

### **2.2 DESCRIPTION**

- A. General Description: Manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance as indicated.
- B. Regulatory Requirements

1. Comply with requirements of ASTM E 580 to meet State seismic requirements for bracing the ceiling suspension system.

C. Sustainability Requirements:

1. Recycled content of acoustical ceiling panels: Use maximum available percentage of materials by weight. Products incorporated into the work shall contain not less than 50 percent of recycled content.
2. Recycled content of steel used in grid framing: Use maximum available percentage of recycled steel. Steel framing products incorporated into the work shall contain not less than 25 percent of recycled steel.

## 2.3 SYSTEM COMPONENTS

A. Ceiling and Soffit Suspension Materials

1. Hanger attachments: Galvanized steel hanger eyes, of size and capacity to safely sustain a live load of at least 150 pounds per hanger attachment.
2. Hangers: Soft temper, pre-stretched galvanized carbon steel wire, conforming with ASTM A641, with a yield stress load of at least three times design load, but not less than 12 gage.
3. Sound isolation hangers: precompressed neoprene rubber and spring isolation hanger; designed for high frequency sound waves and low frequency vibrations. Size hangers as recommended by manufacturer for anticipated ceiling load.
  - a. LD Peters & Sons, Inc., New Rochelle NY, type W30N
  - b. Mason Industries, Inc., Happauge NY, W30N series
  - c. Kinetics, Inc., type SRH series.
4. Grid system for direct attachment of finish board: Comprised of double web main furring tees, 1 1/2 inches high by 1-3/8 inches flange face by 0.020 inch thick; double web cross tees, 1 1/2 inches high by 15/16 inch flange face by 0.020 inch thick; 0.020 inch thick wall channels, with 1 1/2 inches interior web height; and all splices, clips, and related items. Provide Underwriters Laboratories Label fire-rated assemblies for locations requiring fire-rated ceilings and soffits
  - a. Donn (USG) Corporation, Chicago IL., product "USG Drywall Furring System" with DGLW tees.

B. Perimeter edge trim system., designed to accommodate straight edges as well as converse curved and convex curved edges as may be indicated on Drawings. Attachment to grid system is provided by a specially designed attachment clip, which snaps into the locks against hems of trim and is screw-attached to the bulb of the intersection suspension system member. Independent sections of trim are joined together using the splice plate.

1. USG: Compasso series.

C. Transition molding: Manufacturer's proprietary steel formed trim.

D. Gypsum board, Conforming to ASTM C1396 (Section 5) and ASTM C36, 5/8 inch thick perforated for acoustical performance and laminated with white fiberglass scrim on back side..

1. USG: Sheetrock brand "Ensemble series.



- E. Acoustical Panel: 1 inch thick acoustical panels having unfinished face, for backloading perforated gypsum panels.
  - 1. USG Ensemble High NRC Backer panel.
- F. End Joint backer panel, Conforming to ASTM C1396 (Section 5) and ASTM C36, 5/8 inch thick non-perforated..
- G. Board Finishing: Comply with Section 092900 – Gypsum board for a Level 4 finish, using USG Sheetrock Brand Ensemble Ceiling Compound for finishing joints.
- H. Finish coat: USG Ensemble Spray-applied Finish.

#### 2.4 ACCESSORIES

- A. Hanger attachments: Of the most appropriate types for the specific receiving surfaces.
- B. Hangers: ASTM A641 Soft temper, pre-stretched galvanized carbon steel wire, with a yield stress of at least 3 times design load, but not less than 12 gage.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Beginning of installation means acceptance of existing substrate and project conditions.

#### 3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.
- B. Surface Preparation:
  - 1. Carefully examine all receiving surfaces, to which attachments will be made hereunder, and determine the most practical way of making such attachments. Request Architect's approval of any attachment method which differs from that indicated on the approved shop drawings before proceeding with installation.
  - 2. Permit acoustical ceiling tile to reach room temperature and a stabilized moisture content prior to installation.

#### 3.3 INSTALLATION

- A. Comply with requirements of ASTM E580-R84 to meet State seismic requirements for bracing the ceiling suspension system.

- B. Comply with recommendations for "Direct Hung Acoustical Tile and Lay-In Panel Ceilings for Seismic Zones 0-2" as published by Ceilings & Interior Systems Construction Association, Skokie IL.
- C. Install all components of the suspended grid systems in accordance with the manufacturer's instructions, the approved shop drawings, conforming to ASTM C-636 requirements. Ensure a deflection not to exceed 1/360 span of 48-inch simple span.
- D. Install specified edge moldings wherever ceilings intersect a wall or partition surface, and around all items having any dimension of 4 inches or more which penetrate the ceilings, including circular penetrations. Set moldings absolutely level, using as long lengths as practicable, and secure with fasteners recommended by manufacturer for the type of substrate.
  - 1. Screw-attach moldings to substrate at intervals not over 16 inches on center. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.
- E. Install hanger attachments to overhead construction in accordance with the approved shop drawings, spacing the attachments not more than 48 inches on centers over location of each main tee member.
  - 1. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers to span the extra distance.
  - 2. Install hanger wire to attachments with triple twists.
- F. Install main tees parallel to the long dimension of each area, spacing the tees 48 inches on centers. Secure the bottom of hanger wires through slots in the main tee members and tie with triple twists. Level the main tees as the work progresses.
- G. Lateral bracing:
  - 1. Provide lateral bracing as required by applicable codes and regulations.
  - 2. Secure lateral bracing to structural members as detailed on the Drawings.
- H. Uniformly space the cross tees at 24 inches on centers, and secure the cross tees into the main tees as recommended by the system manufacturer.
- I. Install perforated gypsum board and acoustical liner per manufacturer's written instructions.
- J. After compound is fully dry, spray apply finish coat.

### 3.4 TOLERANCES

- A. Maximum variation from flat and level surface: 1/8 inch in 10 feet.
- B. Maximum variation from plumb of grid members caused by eccentric loads: 2 degrees.

3.5 CLEANING

- A. Properly clean surfaces of panels and open grids free from dirt and handling marks. Wherever surfaces cannot be cleaned by normal methods or have defects, remove and replace with new components.
- B. Clean work under provisions of Section 017300 – EXECUTION.

3.6 PROTECTION

- A. Protect finished work under provisions of Section 015000 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

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Section 09 64 33  
LAMINATED WOOD FLOORING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Factory finished engineered hardwood flooring system (designated WD-1).

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING.
- D. Section 09 30 00 – TILING.
- E. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES.
- F. Section 09 65 19 - RESILIENT TILE FLOORING.
- G. Section 09 68 13 - TILE CARPETING.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.
  - 1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
  - 2. FS MM-L-736 - Lumber; Hardwood.
  - 3. WSFI - Recommendations for the Correct Preparation, Finishing, and Testing of Concrete Subfloor Surfaces to Receive Wood Flooring.
  - 4. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 SUBMITTALS

- A. Information and Review Submittals:

1. Literature: Manufacturer's product data sheets, specifications, performance data for each type of wood flooring material, with manufacturer's installation instructions and recommended maintenance procedures.
  2. Installation instructions: Submit manufacturer's instructions, indicating special procedures, perimeter conditions
  3. Manufacturer's warranties: Wood flooring manufacturers' standard written guarantees covering defects in materials and workmanship, clearly defining the terms included in the coverage.
  4. Verification samples:
    - a. Strip flooring: At least six (6) 12-inch long pieces of specified specie, grade, and size of flooring, indicating complete range of color variation which may be expected for the project.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Maintenance data: Include maintenance procedures, recommended maintenance materials, a suggested schedule for cleaning, stripping, and re-finishing, stain removal methods, and polishes and waxes.
- 1.6 QUALITY ASSURANCE
- A. Manufacturer: Companies specializing in manufacturing the products specified in this Section, each with minimum 5 years documented experience.
  - B. Each board of flooring shall bear grade stamp on underside identifying Grading authority, manufacturer's identification, wood species and grade.
- 1.7 REGULATORY REQUIREMENTS
- A. Conform to applicable codes for Class 1 flame spread rating of finished floor surface when tested in accordance with ASTM E 84. Provide certificate of compliance from authority having jurisdiction.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Deliver wood flooring a minimum of 7 days prior to installation to allow materials moisture content to stabilize to ambient conditions. Do not deliver wood until all concrete, masonry, plaster and other wet work is complete and dry, and ambient air at installation space has moisture content stabilized.
  - B. Protect wood flooring from excessive moisture in shipment and handling; store all materials in an elevated, protected, and dry location.
- 1.9 PROJECT CONDITIONS
- A. Maintain ambient temperature between 55 and 80 degrees Fahrenheit, with a relative humidity of between 35 and 50 percent for 48 hours prior to delivery and storage of the flooring materials at the area; maintain such conditions throughout the installation and finishing period, and thereafter until Owner's Final Acceptance or Owner's occupancy.

1.10 SEQUENCING AND SCHEDULING

- A. Sequence work to ensure wood flooring is not delivered until building is enclosed, sufficient heat is provided, and proper humidity conditions can be maintained.
- B. Install wood flooring after interior wet work is complete and fully cured, and ambient air at installation space has a moisture content stabilized.

1.11 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Provide 5 year warranty which shall include coverage for all costs to repair or replace flooring, which shrinks, warps, cracks, or otherwise deteriorates excessively, or which breaks its anchorage, or bond with substrate, or otherwise fails. Warranty shall cover failures due to materials or workmanship. The Installer is not responsible for failure due to excessive moisture penetration through concrete substrate or other similar causes for failure which are beyond the Work of this Section, except verification of acceptable substrates, specified herein.
- C. Provide manufacturer's standard 25 year finish warranty and lifetime structural warranty.

1.12 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to each unit extra materials for future repairs and maintenance, an amount equal to 3 per cent of finish and type flooring installed.
- B. Clearly label and package extra materials securely to prevent damage.

**PART 2 - PRODUCTS**

2.1 FLOORING MATERIALS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Nydree Flooring, LLC., Forest, VA, product "Maple Hardwood"..
- B. Engineered Wood Flooring:
  - 1. Prefinished, tongue and groove, engineered flooring composed of hardwood top layer and 7 layers of Baltic Birch backing.
  - 2. Species: Maple.
  - 3. Grade: Select and better.
  - 4. Thickness: ½-inch.
  - 5. Wear layer: 3 mm.
  - 6. Lengths from 24-78 inches.
  - 7. Width: 5 ¼-inch.
  - 8. Finish: Matte, (Gloss Level 10 per manufacturer) unless otherwise indicated.

- C. Provide wood transitional strips and perimeter closure pieces as required matching selected floor species and finish.

## 2.2 ACCESSORIES

- A. Adhesive: Water-resistant urethane mastic, adhesive as recommended and approved by flooring manufacturer.
- B. Protection paper: Waxed kraft paper or red rosin paper.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that permanent heat, light, and ventilation is complete and operational prior to installation.
- B. Inspect all substrate surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Verify that wood subfloor is properly secured, is smooth and flat to plus or minus 1/8 inch in 10 feet, free of foreign substances.
- C. Verify that required flooring mounted utilities are in proper location.
- D. Beginning of installation means acceptance of existing substrate and site conditions.

### 3.2 PREPARATION

- A. Comply with flooring manufacturer's requirements for preparation of substrate to receive wood flooring.
- B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. Thoroughly vacuum clean all receiving surfaces before commencing installation work.
- D. Open bundles of flooring, and permit the pieces to properly acclimatize prior to installing same.

### 3.3 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions and the WSFI recommendations for subfloor preparation.
- B. Lay flooring in patterns shown on approved shop drawings. Arrange strips with staggered end joints and end grain, matched, set joints flush and tight.
- C. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar. Provide divider strips.
- D. Expansion Space: Provide adequate expansion space at walls, columns or other projections into the floor surface. Provide expansion space per the following:

1. In wood floor areas of less than 1,000 square feet, allow an expansion space equal to 1/16 inch per foot of width of installation.
  2. In wood floor areas of greater than 1,000 square feet, allow an expansion space of 1-3/4 inch at walls and 1 inch at columns and other projections.
- E. Install flooring tight to floor access covers.
- 3.4 CLEANING
- A. As work progresses, remove excess adhesive from floor, base and wall surfaces without damage.
  - B. Clean and polish floor surfaces in accordance with manufacturer's instructions.
- 3.5 PROTECTION
- A. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Prohibit construction traffic for a minimum of 48 hours on completed areas of adhesive applied flooring.
  - B. Cover the all wood floor surfaces, facings, and edgings, with heavyweight non-staining kraft paper and overlay with red-rosin paper, taping the edges to maintain position of the protection paper. Reapply papers as required to maintain floor protection.

End of Section



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Section 09 65 13  
RESILIENT BASE AND ACCESSORIES

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Prepare substrate to receive resilient base.
- B. Furnish and install the following:
  - 1. Coved resilient wall base (typical)
  - 2. Straight (non-coved) resilient wall base at carpets and elsewhere indicated..
  - 3. Profiled wall base at corridors (designated RB-3).

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing finishes.
- D. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete substrate for resilient base.
- E. Section 06 10 00 - ROUGH CARPENTRY: Plywood wood blocking and nailers.
- F. Section 09 29 00 - GYPSUM BOARD: Gypsum board substrate to receive resilient base.
- G. Section 09 65 19 – RESILIENT TILE FLOORING: Vinyl composition tile (VCT) flooring.
- H. Section 09 68 13 – TILE CARPETING: Carpet tile and transition strips.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
  - 2. ASTM F 1861 - Standard Specification for Resilient Wall Base

3. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

## 1.5 ADMINISTRATIVE REQUIREMENTS

### A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

### B. Sequencing:

1. Sequence work to ensure resilient flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
2. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

## 1.6 SUBMITTALS

### A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
  - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all adhesives. Submit MSDS highlighting VOC limits.
2. Selection Samples: Manufacturers' sample chain of colors available for selection by Architect.
3. Verification Samples: Each type resilient base and color selected, 24 inches long.
4. Sustainable Design Submittals:
5. LEED Submittal Requirements:
  - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
    - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
      - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
      - b) EPD shall have at least Cradle to Gate scope,
    - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
    - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
      - a) Itemized vendor invoices for FSC-certified products.
      - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped

- to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
- 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
- c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
- 1) Recycled Content:
    - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
    - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
  - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
    - a) Documentation should be in the form of one of the following:
    - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
    - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
    - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
    - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
    - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
  - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area

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- 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (flooring systems):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for flooring systems installed within the waterproofing membrane.
- B. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, an amount equal 24 linear feet for each color and type of resilient base installed.
- 1.7 QUALITY ASSURANCE
- A. General: Avoid color and pattern differential; provide base from one production run in any single room or contiguous areas.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  2. Deliver resilient base materials in original, unopened packages and store protected for three days prior to installation in area of installation to achieve temperature stability.
- B. Storage and Handling Requirements:
1. Store materials in a clean dry, enclosed space off the ground and protected from the weather. Protect adhesives from freezing.

1.9 SITE CONDITIONS

- A. Maintain uniform temperature of minimum of 65 degrees Fahrenheit and humidity of 20 to 40 percent 48 hours prior to, during, and 48 hours after installation. Store resilient flooring materials and accessories in the spaces where they will be installed for at least 48 hours before beginning installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit in the areas where the work is completed.

1.10 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manufacturer Warranty:
1. Resilient Base: Provide manufacturer's standard one year limited product warranty for resilient base materials.
  2. Adhesives: Provide manufacturer's one year limited product warranty for adhesion reliability.

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Roppe Corporation, Fostoria OH.
  2. Nora Flooring, Salem, NH.
  3. Johnsonite, Middlefield OH.
  4. Burke-Mercer Products Company, San Jose CA.
  5. VPI Corporation, Sheboygan WI.
  6. Tarkett, Inc., Parsippany NH.

2.2 DESCRIPTION

- A. Regulatory Requirements:
1. Provide materials and assemblies conforming to applicable building codes and regulatory agencies for flame/fuel/smoke rating requirements of base trim in accordance with ASTM E 84.

2.3 RESILIENT BASE

- A. Rubber Base: 4 inches high, ribbed back, 1/8 inch thick, rounded top complying with ASTM F-1861, Type TP, Thermoplastic Rubber (TBR). Colors shall be as selected. Rubber base shall be furnished in continuous lengths, approximately 100 feet long.
1. Provide coved base at resilient flooring (designated RB-1)
  2. Coved base at sealed concrete floors, and back-of-house spaces not having a finished floor (designated RB-1).

3. Provide straight (non-covered) base at carpeted areas, walk-off entrance mat areas and elsewhere scheduled (designated RB-2).
- B. Molded base (designated RB-3): 4-1/4 inches high, flat back, profiled, complying with ASTM F-1861, Type TP, Thermoplastic Rubber (TBR). Colors shall be as selected.
  1. Basis of Design: Roppe Corporation, Fostoria OH, product "Pinnacle Plus".
- C. Base accessories: Premolded end stops of same material, size and color as base. Job-form all external and internal corners from base material, pre-molded corner pieces will not be acceptable

## 2.4 ACCESSORIES

- A. Adhesives
  1. General: Water resistant, low VOC, acceptable to the resilient flooring manufacturer, for substrate conditions.
    - a. Cove Base Adhesives: Maximum VOC 50 [g/L less water]
  2. Acceptable manufacturers:
    - a. Advanced Adhesive Technology, Inc, Dalton GA, product: "No. 432 Modified Acrylic Cove Base Adhesive".
    - b. DAP Incorporated, Dayton OH, product: "Cove Base Construction Adhesive".
    - c. W.W. Henry Company, Aliquippa PA., product: "Henry 440 Cove Base Adhesive".
    - d. Roberts Consolidated Industries, Inc., City of Industry, CA, product: "Premium Solvent-Free Cove Base Adhesive".
- B. Joint Sealer for between the top of wall base and irregular wall surfaces: Plastic filler as recommended by manufacturer.
- C. Cleaning material: Domestic neutral floor detergent having a pH 7 or pH 8, as recommended by the flooring manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Beginning of installation means acceptance of existing substrate and site conditions.

### 3.2 INSTALLATION

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.

- B. Spread only enough adhesive to permit installation of materials before initial set.
- C. Install Resilient base: Install base on solid backing, bond to vertical substrate with continuous contact at horizontal and vertical surfaces. Apply wall base to walls, columns, casework and other permanent fixtures in areas where base is required.
  - 1. Install in lengths as long as practical.
  - 2. Scribe to fit to door frames and other interruptions.
  - 3. Form all external and internal corners in accordance with manufacturer's written instructions. Cope inside corners and fit neatly.
  - 4. Fill voids with plastic filler along the top edge of the resilient wall base on masonry surfaces or other similar irregular substrates.

### 3.3 CLEANING

- A. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for handling and disposition of all construction and demolition waste.
- B. Post-installation Cleaning: As installation progresses, continually remove excess adhesive from floor, base and wall surfaces without damage.

End of Section



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Section 09 65 19  
RESILIENT TILE FLOORING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Bio-Based (non-PVC) urethane plank flooring (designated RT).
  - 2. Transition strips wherever edges of resilient tile flooring materials abut dissimilar flooring, where no thresholds occur.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 03 01 36 - RESURFACING AND PATCHING OF CONCRETE SLABS.
- D. Section 03 30 00 - CAST IN PLACE CONCRETE.
- E. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING.
- F. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES: Resilient wall base (designated RB).

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.
  - 1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
  - 2. ASTM F-710 - Preparing Concrete Floors to Receive Resilient Flooring.
  - 3. ASTM F-1869 – Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
  - 4. FS SS-T-312 - Tile, Floor: Asphalt, Rubber, Vinyl, Vinyl Composition.
  - 5. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

## 1.5 REGULATORY REQUIREMENTS

- A. Provide materials and assemblies conforming to applicable building codes and regulatory agencies for flame/fuel/smoke rating requirements of flooring in accordance with ASTM E 84.
- B. Provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:
  - 1. ASTM E 648 (Critical Radiant Flux) of 0.45 watts per sq. cm. or greater, Class 1.
  - 2. ASTM E 662 (Smoke Generation) Maximum Specified Optical Density of 450 or less.

## 1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
  - 2. Submit the manufacturer's certification that the resilient flooring has been tested by an independent laboratory and complies with the required fire tests.
  - 3. Shop drawings: 1/4 inch scale plans of each flooring area scheduled for Work of this Section. Drawings shall bear dimensions of actual measurements taken at the project.
    - a. Identify each flooring type, colors and patterns, indicate layout of tile units and direction of tile patterns.
    - b. Where more than one adhesive type is specified or otherwise required by flooring manufacturer, identify on shop drawings areas for each adhesive type.
  - 4. Selection samples: Manufacturers' sample chain of colors and patterns available for selection by Architect.
  - 5. Verification samples:
    - a. Full sized flooring tile, illustrating color, and pattern for each color and type of tile selected.
    - b. Edging: 12 inches long demonstrating profile, thickness, size and color.

## 1.7 QUALITY ASSURANCE

- A. Provide types of resilient tile and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.
- B. Avoid color and pattern differential; provide flooring from one production run in any single room or contiguous areas.

## 1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver resilient flooring materials in original, unopened packages and store protected for three days prior to installation in area of installation to achieve temperature stability.

- B. Store materials in a clean dry, enclosed space off the ground and protected from the weather. Protect adhesives from freezing.

#### 1.9 ENVIRONMENTAL CONDITIONS

- A. Maintain uniform temperature of minimum of 65 degrees Fahrenheit and humidity of 20 to 40 percent 48 hours prior to, during, and 48 hours after installation. Store resilient flooring materials and accessories in the spaces where they will be installed for at least 48 hours before beginning installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit in the areas where the work is completed.

#### 1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work.
- B. Sequence work to ensure resilient flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
- C. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

#### 1.11 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
  - 1. Manufacturer's standard wear warranties (minimum of 2 year), for all flooring and stair tread materials installed under this Section.

#### 1.12 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra flooring materials for future repairs and maintenance, from the same manufacturing runs as those installed, in the following amounts.
  - 1. Vinyl composition tile: 3 percent of each material in each color, and pattern installed.
  - 2. Furnish a quantity of adhesive of each type used in sealed cans or containers sufficient to apply the above materials.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE CRITERIA

- A. Regulatory Requirements:
  - 1. Provide materials and assemblies conforming to applicable building codes and regulatory agencies for flame/fuel/smoke rating requirements of flooring in accordance with ASTM E 84.
  - 2. Provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:

- a. ASTM E 648 ( Critical Radiant Flux ) of 0.45 watts per sq. cm. or greater, Class 1.
- b. ASTM E 662 ( Smoke Generation ) Maximum Specified Optical Density of 450 or less.

## 2.2 VINYL PLANK FLOORING (DESIGNATED RT)

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Patcraft, Dalton GA., product "Enrich Plank" a bio-based polyurethane heterogeneous plank. Complies with the requirements of ASTM F 1700, Class III, Type B.
  1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    - a. Patcraft, Dalton GA. (Basis of Design)
    - b. Shaw Industry Group Inc., Dalton GA.
    - c. MatsInc., (Wineo Purline Brand), Stoughton MA.
  2. Characteristics:
    - a. Vinyl flooring composed of a bio-based polyurethane heterogeneous plank.
    - b. Plank size: 9.84 inch width by 59.05 inch length (25 cm by 150 cm).
    - c. Thickness: 0.098 inches (2.5 mm).
    - d. Color and pattern shall be as selected by the Architect from manufacturer's full available range of "wood grain" colors.

## 2.3 ACCESSORIES

- A. Filler for patching, smoothing and leveling flooring substrate: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- B. General Requirements for flooring Adhesives: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- C. Transition and edge strips:
  1. General: Homogeneous rubber, of profiles required for thickness of abutting materials.
  2. Edge strips: Tapered or bull nose edge.
  3. Colors: Match or contrast with the flooring, as selected by the Architect from standard colors available, of width shown on the drawings.
- D. Cleaning material: Domestic neutral floor detergent having a pH 7 or pH 8, as recommended by the flooring manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

- B. Verify concrete substrate has been cured and is sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture test.
- C. Beginning of installation means acceptance of existing substrate and site conditions.

### 3.2 PREPARATION - GENERAL

- A. General: Comply with flooring manufacturer's requirements for preparation of substrate to receive resilient flooring.
  - 1. Close spaces to traffic during the installation of the flooring.
- B. Remove, by light sanding and grinding, all protruding edges, high spots. Ensure that substrate is free from paint, varnish, wax, oil, or other foreign matter.
- C. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler. Apply, trowel and float finish subfloor filler and leave a smooth, level, hard surface. Prohibit traffic from area until filler is cured.
- D. Vacuum clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring.

### 3.3 INSTALLATION - GENERAL

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
  - 1. Apply primers as recommended by adhesive manufacturer's written instructions.
- B. Spread only enough adhesive to permit installation of materials before initial set.
- C. Mix tile to ensure that concentration of surface patterns is uniform throughout. Use tile from cartons in same sequence as manufactured and packaged, if so numbered.

### 3.4 INSTALLATION - FLOOR TILE

- A. Lay flooring in a square grid pattern, with joints and seams parallel to building lines. Lay tile flooring in pattern as indicated on the drawings or if not indicated as such, lay with alternating pattern-grain to form a basket weave pattern. Lay tile with joints straight and continuous in both directions and with border tile not less than 1/2 the width of the tile.
- B. Neatly fit resilient materials to all intersecting surfaces, and make joints as inconspicuous as possible.
- C. Terminate flooring at centerline of door in closed position where adjacent floor finish is of different material or color.
- D. Apply resilient materials to have uniform contact with receiving surfaces throughout, with tight joints, and with all finish surfaces smooth, in true plane, free from buckles, waves, and other imperfections.

- E. Extend resilient flooring to wall lines beneath all movable equipment and movable casework. Fit resilient flooring onto breaks and recesses, against non-resilient bases, around pipes and other protrusions, under saddles, and to and around other fixed surfaces, making neat cuts in the flooring and minimizing joints.

### 3.5 INSTALLATION OF ACCESSORIES

- A. Resilient edge and transition strips:
  - 1. Install edge strips at all edges of flooring which would otherwise be exposed.
  - 2. Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.

### 3.6 PROTECTION

- A. Prohibit traffic on finished floor areas until flooring adhesive has fully set.
- B. Prohibit washing, scrubbing or other similar 'wet' operations to occur on finished floor areas for a minimum period of 5 calendar days after installation.
- C. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Cover all resilient tile floor surfaces with non-staining heavyweight kraft paper and overlay with red-rosin paper, taping the edges to maintain position of the protection paper. Reapply papers to maintain floor protection.

### 3.7 POST-INSTALLATION CLEANING

- A. As installation progresses, continually remove excess adhesive from floor, and wall surfaces without damage.
  - 1. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.
- B. Sweep floors to remove all loose dirt and debris.
- C. After specified waiting period, clean all materials installed hereunder with a non-abrasive commercial detergent approved by the material manufacturers, and thoroughly rinse with clear water.
  - 1. Vinyl composition tile floors: Wait at least 5 full days following completion of tile installation before commencing with cleaning.

### 3.8 FINAL CLEANING

- A. General: Perform final cleaning not before 4 days prior to Owner's intended occupancy date.
- B. Vinyl composition tile floors:
  - 1. Wash floors with non-abrasive commercial detergent with floor machine equipped with green or blue pad. Apply manufacturer's recommended stripping solution when floors are badly soiled.
  - 2. Apply a minimum of four coats of acrylic floor polish to protect flooring until regular maintenance procedures can be started.

3. After application and curing of floor polish, ensure that polished floors are protected with heavy kraft paper.

3.9 PROTECTION

- A. After cleaning and polishing, ensure that the flooring is be protected with heavy kraft paper.

End of Section



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Section 09 65 66  
RESILIENT ATHLETIC FLOORING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Resilient athletic flooring and accessories.
    - a. Markings and game lines as indicated on Drawings.
  - 2. Transition strips wherever edges of resilient athletic flooring materials abut dissimilar flooring, where no thresholds occur.

1.3 RELATED SECTIONS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 03 01 36 - RESURFACING AND PATCHING OF CONCRETE SLABS.
- D. Section 03 30 00 - CAST IN PLACE CONCRETE.
- E. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
  - 2. ASTM D 2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as measured by the James Machine.
  - 3. ASTM D 2240 - Standard Test Method for Rubber Property (Durometer Hardness).
  - 4. ASTM D 3389 - Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader).

5. ASTM E 492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine.
6. ASTM E 84 - Surface Burning Characteristics of Building Materials.
7. ASTM E 648  
Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
8. ASTM E 1643 -  
Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
9. ASTM E 1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
10. ASTM F 386 - Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces.
11. ASTM F 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
12. ASTM F 925 - Standard Test Method for Resistance to Chemicals of Resilient Flooring.
13. ASTM F970  
- Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading.
14. ASTM F 1514 - Standard Test method for Measuring Heat Stability of Resilient Flooring by Color Change.
15. ASTM F 1515 - Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change.
16. ASTM F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
17. ASTM F 2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
18. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

## 1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
    - a. Furnish manufacturer's product literature on flooring adhesive, highlight adhesive properties, including VOC's and maximum moisture pressure limits for substrates.
  2. Submit the manufacturer's certification that the resilient flooring has been tested by an independent laboratory and complies with the required fire tests.

- a. GREENGUARD Certification. Compliant with stringent emission levels for over 360 VOCs, plus a limit on the total of all chemical emissions combined (TVOC).
  - b. GREENGUARD Gold. Compliant with safety factors to account for sensitive individuals (such as children and the elderly) and ensures that a product is acceptable for use in environments such as schools and healthcare facilities.
3. Shop drawings: 1/4 inch scale plans of each flooring area scheduled for Work of this Section; indicate layout of tile units and direction of tile patterns, identify selected colors and patterns.
  4. Selection samples:
    - a. Manufacturers' sample chain of colors and patterns available for selection by Architect.
  5. Verification samples:
    - a. Sheet flooring: 12 by 12 inch illustrating color, and pattern for each color and type of flooring selected.
    - b. Edging: 12 inches long demonstrating profile, thickness, size and color.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Maintenance data: Include maintenance procedures, recommended maintenance materials, a suggested schedule for cleaning, stain removal methods, and polishing.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer: Provide resilient flooring manufactured by a firm with a minimum of 10 years experience in the fabrication of resilient flooring of types equivalent to those specified.
  1. Manufacturer capable of providing field service representation.
- B. Installer's Qualifications: Installer experienced (minimum of 2 years) to perform work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to the product manufacturer.
- C. Materials: For each type of material required for the work of this Section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturer of the primary materials. Comply with applicable regulations regarding VOC (volatile organic compound) content of adhesives.
- D. Color Matching: Provide resilient flooring products, including accessories, from one manufacturer to ensure color matching.
  1. Avoid color and pattern differential; provide flooring from one production run in any single room or contiguous areas.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver resilient flooring materials in original, unopened packages and store protected for three days prior to installation in area of installation to achieve temperature stability.

- B. Store materials in a clean dry, enclosed space off the ground and protected from the weather. Protect adhesives from freezing.

#### 1.8 ENVIRONMENTAL CONDITIONS

- A. Maintain uniform temperature of minimum of 65 degrees Fahrenheit and humidity of 20 to 40 percent 48 hours prior to, during, and 48 hours after installation. Store resilient flooring materials and accessories in the spaces where they will be installed for at least 48 hours before beginning installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit in the areas where the work is completed.

#### 1.9 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work.
- B. Sequence work to ensure resilient flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated and work overhead is completed.
- C. Install flooring after interior wet work is dry.

#### 1.10 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 - WARRANTIES.
- B. Provide manufacturer's standard wear warranties for all flooring and accessory materials installed under this Section.

#### 1.11 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, from the same manufacturing runs as those installed, in the following amounts:
  - 1. Flooring: 3 percent of each material in each color, and pattern installed.
  - 2. Furnish a quantity of adhesive of each type used in sealed cans or containers sufficient to apply the above materials.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on the following manufacturers and products.
  - 1. Resilient athletic flooring:
    - a. Mondo USA, Inc., Conshohocken, PA, product, "Advance Vulcanized", thickness 10mm.

## 2.2 RESILIENT ATHLETIC FLOORING

- A. Prefabricated resilient athletic flooring: Calendered, vulcanized, base of natural and synthetic rubbers, stabilizing agents and pigmentation complying with the following:
1. Elongation at Break when tested in accordance with ASTM D412: Minimum 100%.
  2. Tensile Strength when tested in accordance with ASTM D412: minimum of 300 psi.
  3. Static Coefficient of Friction when tested in accordance with ASTM D2047:  $\geq 0.50$  (dry).
  4. Hardness Range (top layer) when tested in accordance with ASTM D2240: 78 + or - 5 Shore A.
  5. Hardness Range (bottom layer) when tested in accordance with ASTM D2240: 50 + or - 5 Shore A.
  6. Critical Radiant Flux when tested in accordance with ASTM E648:  $0.22 \geq$  W/cm<sup>2</sup> (Class 2).
  7. Abrasion Resistance (H18 wheel, 1000 g, 1000 cycles) when tested in accordance with ASTM D3389:  $\leq 1.0$  g.
  8. Thickness when tested in accordance with ASTM F386: 0.394 inch (10 mm).
  9. Construction: Triple durometer construction, vulcanized into a single prefabricated sheet for optimal performance and durability. The Shore hardness of the top layer (wear layer) will be greater than that of the other layers; Shore hardness of layers to be recommended by the Manufacturer and to respect limits specified.
    - a. Health-Conscious Production: Resilient flooring shall free from red listed ingredients (LBC Red List) and manufactured without bisphenol A (BPA), formaldehyde, halogens, heavy metals, isocyanates, phthalates and polyvinyl chloride (PVC).
    - b. Surface Texture: Smooth, matte.
- B. Size: Sheet width, 6 feet 1 inch (1.86 m) by 42 feet 7 inches (13 m) long.

## 2.3 ACCESSORIES

- A. Filler for patching, smoothing and leveling flooring substrate: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- B. General Requirements for flooring adhesives: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING, acceptable by the resilient flooring manufacturer
- C. Transition strips: Formed rubber, of profiles required for thickness of flooring system to abutting materials, in colors matching fitness floor.
- D. Cleaning material: Domestic floor detergent, as recommended by the flooring manufacturer.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Substrates shall be dry and clean.
  - 2. Substrates shall be free of depressions, raised areas, or other defects which would telegraph through installed flooring.
  - 3. Temperature of resilient flooring and substrate shall be within specified tolerances.
- B. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to requirements of Section 09 05 06 – COMMON WORK RESULTS FOR FLOORING.
- C. Beginning of installation means acceptance of existing substrate and site conditions.

#### **3.2 PREPARATION**

- A. General: Comply with requirements specified under Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING, the flooring manufacturer's requirements for preparation of substrate to receive resilient flooring, and as additionally specified herein.
- B. Condition flooring materials, accessories and adhesives to room temperatures for a period of 48 hours minimum.
- C. Apply primers as recommended by adhesive manufacturer's written instructions.

#### **3.3 INSTALLATION - GENERAL**

- A. General: Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
- B. Install resilient flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring. Do not install resilient flooring over concrete slabs until they have been cured and are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture test.
- C. Spread only enough adhesive to permit installation of materials before initial set.

#### **3.4 INSTALLATION**

- A. Neatly fit resilient materials to all intersecting surfaces, and make joints as inconspicuous as possible.
- B. Terminate flooring at centerline of door in closed position where adjacent floor finish is of different material or color.

- C. Apply resilient materials to have uniform contact with receiving surfaces throughout, with tight joints, and with all finish surfaces smooth, in true plane, free from buckles, waves, and other imperfections.
- D. Extend resilient flooring to wall lines beneath all movable equipment and movable casework. Fit resilient flooring onto breaks and recesses, against non-resilient bases, around pipes and other protrusions, under saddles, and to and around other fixed surfaces, making neat cuts in the flooring and minimizing joints.
- E. Install reducer strips at all exposed edges and transitions with abutting flooring systems.

### 3.5 INSTALLATION OF ACCESSORIES

- A. Resilient edge and transition strips:
  - 1. Install edge strips at all edges of flooring which would otherwise be exposed.
  - 2. Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.

### 3.6 PROTECTION

- A. General: Protect finished work under provisions Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- B. Prohibit all traffic on finished floor areas for a minimum period of 12 hours.
- C. Protect finished floor areas from sun and moisture and construction traffic for a minimum period of 2 calendar days after installation.
- D. Prohibit washing, scrubbing or other similar 'wet' operations to occur on finished floor areas for a minimum period of 5 calendar days after installation.

### 3.7 CLEANING

- A. As installation progresses, continually remove excess adhesive from floor, base and wall surfaces without damage.
  - 1. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.
- B. Sweep floors to remove all loose dirt and debris.
- C. Not sooner than five days after installation, clean all materials installed hereunder with a non-abrasive commercial detergent approved by the material manufacturers, and thoroughly rinse with clear water.

### 3.8 PROTECTION

- A. Prohibit traffic on finished floor areas until flooring adhesive has fully set.
- B. Prohibit washing, scrubbing or other similar 'wet' operations to occur on finished floor areas for a minimum period of 5 calendar days after installation.

End of Section





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Section 09 66 23  
RESINOUS MATRIX TERRAZZO

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
  - 1. One-piece, precast epoxy terrazzo stair treads/risers.
  - 2. Epoxy terrazzo 12 inch by 24 inch tile at stair landings, and elsewhere as indicated on Drawings.
  - 3. Epoxy terrazzo coved base where indicated on Drawings.
  - 4. Installation systems, adhesives, mortars and grouts.

1.3 RELATED REQUIREMENTS

- A. Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS: Application of protection paper to finished resilient flooring.
- B. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- C. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- D. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- E. Section 05 50 00 – METAL FABRICATIONS: Stair construction to receive terrazzo treads and risers.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ANSI A108.1B - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
  - 2. ANSI A108.4 - Installation of Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.

3. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
4. ANSI A108.6 - Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.
5. ANSI A108.10 - Installation of Grout in Tilework.
6. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People.
7. ASTM C 150 - Portland Cement.
8. ASTM D-635 – Rate of Burning an/or Extent and Time of Burning of Self Supporting Plastics in a Horizontal Position.
9. ASTM D-696 – Coefficient of Linear Thermal Expansion of Plastics.
10. NTMA - published standards and specifications.
11. United States Department of Justice, N° 28 CFR Part 36 - Americans with Disabilities Act, (Public Law 101-336).

## 1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
  2. Shop drawings:
    - a. 1/4 inch scale plans and sections of terrazzo stair indicating layout of tread/risers.
    - b. Large scale details of tread/risers showing profiles, reinforcement and attachment hardware.
  3. Samples:
    - a. Two samples 12 x 12 inch in size illustrating chip size variation, color mix, and mortar color.
  4. LEED Submittal Requirements:
    - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
      - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
        - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
        - b) EPD shall have at least Cradle to Gate scope,
      - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
    - b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
      - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
        - a) Itemized vendor invoices for FSC-certified products.
        - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped

- to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
- 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
- c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
- 1) Recycled Content:
    - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
    - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
  - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
    - a) Documentation should be in the form of one of the following:
    - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
    - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
    - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
    - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
    - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
  - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area

- 
- 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.
- f. Indoor Environmental Quality Credit 3: Low-Emitting Materials (flooring systems):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for flooring systems installed within the waterproofing membrane.
- B. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra materials in, an amount equal to 3 percent of tile and trim of each color, finish and type installed.

1.6 QUALITY ASSURANCE

- A. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.
- B. Manufacturer: with a minimum of 5 years verifiable experience providing materials of the type specified in this section.
- C. NTMA Standards: Comply with specified provisions and recommendations of National Terrazzo & Mosaic Association, Inc. (NTMA).

1.7 DELIVERY, STORAGE AND HANDLING

- A. Store and protect containers above floor level, keep dry until ready for use.
- B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions. Store epoxy mortar and epoxy grouts at 70 degrees Fahrenheit (21° C) temperature for 24 hours prior to use.

1.8 ENVIRONMENTAL CONDITIONS

- A. Do not install setting or grouting materials in a closed, unventilated environment.
- B. Maintain ambient temperatures between 50 degrees Fahrenheit (10° C) and 95 degrees Fahrenheit (35° C) in tiled areas, for 24 hours prior to installation, during installation and for 7 days after completion.
- C. Ventilate spaces where work of this Section occurs, during and for a period of 72 hours after completion of curing. Ventilate to dissipate humidity, and to prevent accumulation of fumes, vapors, and gases. Provide temporary fan units and ducting as required to for venting operations

1.9 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra tile materials for future repairs and maintenance, from the same manufacturing runs as those installed, in the following amounts.
  - 1. Terrazzo tile: 3 percent of each material in each color, and pattern installed.

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Wausau Tile, Inc., Wausau, WI,
  - 1. Precast treads: Wausau Tile E-30 precast epoxy terrazzo treads with nosing inserts 1 inch thick, honed finish.
  - 2. Tile: Wausau Tile "Tectura Terrazzo Tile" precast epoxy tiles 12 inches by 24 inches by 3/4 inch thick, honed finish.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Terrazzo tread/risers and tile:
  - a. Coverings Etc., (ECO-TERR), Miami, FL
  - b. Wausau Tile, Rothchild, WI.
  - c. Tile Tech Pavers, Los Angeles, CA.
2. Setting materials:
  - a. Laticrete International, Inc., Bethany CT
  - b. Mapei Corporation, Elk Grove IL.

## 2.2 MANUFACTURED UNITS

- A. Materials:
  1. Portland Cement: ASTM C-150 specifications for Portland Cement.
  2. Aggregates: All aggregates to meet ASTM C-33 specifications, cleaned and graded to size. Aggregate shall be blended to meet individual project requirements. Aggregates to meet ASTM C- 13 1.
  3. Coloring: Pigments used shall be inorganic, resistant to alkalinity and used per manufacturer's recommendations.
  4. Color Blending: Precast terrazzo has a color range in the aggregate. This can cause slight variances in overall color. Tile is to be blended at the job site from multiple pallets in numerical sequence.
- B. Precast terrazzo units (including base and treads):
  1. Finish: Honed as approved by the Architect.
    - a. Gloss percentage: 50 percent.
    - b. Average Static Coefficient of Friction (ASTM C 1028):
      - 1) Wet: 0.56
      - 2) Dry: 0.79
    - c. Surfaces to be uniform in appearance.
  2. Colors:
    - a. Field tile, base and treads: Color to be selected from full range of Traditional, Atmosphere, River Run, Micro and Recycled Class collections. Multiple color selections will be required.
    - b. Accent tile: Custom color to match Architect's control sample.
- C. Physical properties:
  1. Coefficient of friction per ASTM C-1028:
    - a. Honed Dry: 0.71; Wet: 0.68.
  2. Resistance to Fire: ASTM Class 0.
  3. Freeze-Thaw per ASTM C-666: None (300 cycles).
  4. Compressive Strength per ASTM C-170: 14,000 - 24,000 psi.
  5. Modulus of Rupture per ASTM C-99: 1,550 psi.
  6. Flexural Strength per ASTM C-880: 1,973 psi.
  7. Water Absorption per ASTM C-97: 3.2 percent.

### 2.3 SETTING MATERIALS

- A. Self-leveling cementitious underlayment (factory pre-mixed) with primer. Provide primer at substrate conditions as recommended by manufacturer:
  - 1. Acceptable products include the following, or approved equal:
    - a. Mapei product: "Ultra/Plan Extreme" with primer.
    - b. Laticrete product: "86 LatiLevel", with primer.
    - c. Custom Building Products "Level Quik RS" , with primer.
- B. Anti-fracture membrane for crack suppression and substrate crack isolation:
  - 1. Acceptable products include the following, or approved equal:
    - a. Mapei product: "Plani/Lastic".
    - b. Laticrete product "Blue 92".
    - c. Custom Building Products "Crack Buster Pro" or "Fracture Free".
- C. Setting Mortar (Bond Coat): Medium bed trowelled, latex modified portland cement hydraulic mortar complying with performance requirements of ANSI A 118.4.
  - 1. Acceptable products include the following, or approved equal:
    - a. Mapei product: "Grani-Rapid".
    - b. Laticrete product: "254 Platinum".
    - c. Custom Building Products "Porcelain Tile Mortar"
- D. Grout: Acrylic modified Portland cement sanded grout conforming to ANSI 118.6.
  - 1. Acceptable products include the following, or approved equal:
    - a. Mapei product: "Ultracolor" with acrylic latex additive "Plastijoints",
    - b. Laticrete product "Laticrete 1500 Series (sanded) with admix 1776 antimicrobial.
    - c. Custom Building Products PolyBlend sanded grouts.
  - 2. Grout Colors: To be determined by Architect, based upon final selection of colors for precast terrazzo. May require a custom color if satisfactory color is not available in manufacturer's standard range.

### 2.4 ACCESSORIES

- A. Metal edge trim: As manufactured by Schlüter Systems L.P., Plattsburgh NY. or approved equal. Extruded aluminum, mill finish, of width shown on the drawings and of required thickness to protect exposed edges of the resilient flooring. Provide units of maximum available length to minimize the number of joints.
- B. Sealer: As recommended by terrazzo tile manufacturer, colorless, penetrating liquid type to completely seal cementitious matrix surface; not detrimental to terrazzo components.



### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that field measurements are as shown on shop drawings.
  - 1. Do not install terrazzo tile flooring until concrete slab substrate is cured (not less than 28 calendar days minimum) and determined to be acceptable to installer.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

#### 3.2 TERRAZZO TILE INSTALLATION

- A. Description: Extra-heavy service rating, medium-set tile installation with polymer modified mortar applied over self-leveling mortar bed.
- B. General: Install in accordance with ANSI A108.5, TCNA installation method number F205, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
  - 1. System Components:
    - a. Anti-fracture membrane.
    - b. Cementitious self-leveling underlayment with primer.
    - c. Bond coat: polymer-modified hydraulic mortar.
    - d. Grout materials: Portland cement sanded grout.
- C. Install anti-fracture membrane over existing cracks and joints in substrate materials. (TCNA F125-Full).
- D. Install cementitious self-leveling underlayment primer and underlayment.
- E. Install latex/portland cement mortar bed (bond coat) to a nominal uniform thickness of 3/8 to 3/4 inch (6mm to 18mm).
- F. Install terrazzo tile ensuring mortar coverage of at least 80 percent on back of tile.
  - 1. Clean terrazzo tile tiles (backs) and remove manufacturer's residue.
  - 2. Back-butter tile to ensure mortar coverage.
- G. Grouting:
  - 1. Allow tile to fully set prior to grouting; do not grout in less than 48 hours after installation of tile.
  - 2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.
- H. Clean terrazzo flooring and apply terrazzo tile sealer as recommended by tile manufacturer, after grout has fully cured, but not less than 72 hours after application of grout.

3.3 CLEANING

- A. Clean and polish floor terrazzo tile in accordance with the manufacturer's written recommendations, immediately prior to Substantial Completion.

3.4 PROTECTION

- A. Floors: Protect floors from foot traffic for at least 24 hours, and 72 hours for general traffic, after completion of installation (including grouting, cleaning and sealing).
  - 1. Prohibit heavy traffic on floors for at least 7 days after installation.

End of Section

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Section 09 68 13  
TILE CARPETING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. General: The work of this Section consists of tile carpeting where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, substrate testing and preparation, furnishing and installation of flooring, and temporary protection until Owner's acceptance.
- B. Prepare substrates to receive carpet tile as required to ensure specified tolerance level for finish surface of carpeting. Preparation work includes patching, smoothing and leveling subfloors and underlayment, including:
  - 1. Grinding down high spots of substrate.
  - 2. Providing Portland cement-based latex underlayment (filler).
- C. Furnish and install carpet tile (designated CPT) directly adhered over floors, where indicated on the Drawings, including all accessories necessary to complete the work

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing flooring finishes.
- D. Section 03 30 00 - CAST-IN-PLACE CONCRETE: substrate.
- E. Section 06 20 00 - FINISH CARPENTRY: Wood thresholds and bases, installing metal thresholds.
- F. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection, for flooring work provided under this Section 09 68 13.
- G. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES: Straight resilient bases, where indicated in conjunction with carpeting.

- H. Section 09 68 13 – TILE CARPETING: Broadloom carpet, and related transition strips.
- I. Division 26 - ELECTRICAL: In-floor electrical receptacles.

#### 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM D 2859 - Test Method for Flammability of Finished Textile Floor Covering Materials.
  - 2. ASTM D5116 - Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
  - 3. ASTM E 84 - Surface Burning Characteristics of Building Materials.
  - 4. ASTM E 648 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
  - 5. CRI Indoor Air Quality Testing and Labeling Program.
  - 6. NFPA: Publication 253 - Test for Critical Radiant Flux of Floor Covering Systems.
  - 7. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING.
- C. Sequencing:
  - 1. Remove and replace existing carpet in accordance with a pre-approved reuse and/or recycling plan.
  - 2. Sequence work to ensure carpeting is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
  - 3. Ensure that installation of flooring and accessories occurs after other finishing operations and interior wet work is complete and fully cured, including painting.

#### 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, for each item furnished hereunder, including carpet, accessories, adhesives, and leveling materials.
  - a. Recycling Plan: Manufacturer shall also submit a plan for recycling the specified carpet and related items at the end of the carpet's useful life.
2. Manufacturer's installation instructions: Provide manufacturer's application methods or installation instructions for each item furnished hereunder. Indicate special procedures, and perimeter conditions requiring special attention.
3. Manufacturer's sample warranties.
4. Manufacturer's certificate: Provide certificate stating that the carpet, and other related materials to be supplied hereunder meet all requirements specified herein.
  - a. Submit certification from the fiber producer verifying use of the branded fiber in the submitted carpet product.
  - b. Certification should include the % recycled content by weight for fibers, describing the source of this recycled content. If virgin nylon is used, the manufacturer shall include, as part of the fiber certification, the precise method that will be used to recapture the nylon at the end of the useful life of the carpet. State whether it will be returned to nylon carpet, yarn production, downcycled to an end use other than carpet yarn used for waste-to-energy conversion, or disposed of in a specified manner.
5. Indoor Air Quality Test Reports: Submit for specified products, indicating that the test results do not exceed the stated emission criteria of the CRI Indoor Air Quality Testing Program.
6. Recycling Instructions
  - a. Submit written certification of environmental compliance describing all aspects of recycling programs for carpet uplifted for replacement and for carpet to be installed, including compliance by the carpet manufacturer and carpet trade contractor.
  - b. A representative from the carpet manufacturer shall meet with the contractor in the presence of a representative of the end user and architect/design firm to review the recommended procedures, prior to occupancy of the finished spaces.
7. Shop drawings: 1/8 inch scale plans of all carpeted areas indicating direction of carpet, location of seams and method of joining seams.
  - a. Show location of different patterns or styles of carpet.
    - 1) Show location of different fiber types, If mixed fiber types are used on the project, the fiber type must be clearly identified to facilitate future recycling.
8. Selection samples:
  - a. Sample swatches containing manufacturer's full color and blend range.
  - b. Vinyl edge strip sample illustrating manufacturer's full color range.
9. Verification samples:
  - a. 12 inch long samples of edge strip.

- b. After initial selection of carpet and color blends has been made by the Architect: 18 by 27 inch sample of selected carpet for final approval of the Architect. Approved samples shall be used as the standard of quality and colors for materials furnished under this Contract.
10. LEED Submittal Requirements:
- a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
    - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
      - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
      - b) EPD shall have at least Cradle to Gate scope,
    - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
    - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
      - a) Itemized vendor invoices for FSC-certified products.
      - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
    - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
  - c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
    - 1) Recycled Content:
      - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
      - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
    - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
      - a) Documentation should be in the form of one of the following:
      - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
      - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.

- 
- d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
  - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
  - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
- 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (flooring systems):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for flooring systems installed within the waterproofing membrane.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.



1. Maintenance Data: Prior to Project Substantial Completion, deliver to the Architect copies of the carpet manufacturer's detailed maintenance recommendations for the care cleaning and stain-removal, and repair of the types of carpets installed. Include product data and Material Safety Data Sheets (MSDS) for cleaning materials.
  2. When the installation is complete, the manufacturer shall deliver (1) a certificate of recycling, which describes the method by which the uplifted carpet was recycled; and (2) a warranty of recycling, which specifies the method by which the new carpet tile will be recycled at the end of its useful life.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
1. Extra Materials: Upon completion of the Work of this Section, Deliver to the Owner extra materials for future repairs and maintenance. Clearly label and package securely to prevent damage.
    - a. Owner's carpet tile stock: An amount equal to 3 percent of each color, pattern and type of carpet installed.
    - b. Stock not turned over to Owner: Recycle waste, unusable scrap, and carpet tile damaged during installation through manufacturer's environmental program.
  2. Deliver specified overrun and usable pieces of carpet tile to owner's designated storage space, properly packaged and identified. Redirect small pieces of waste carpet to be appropriately recycled.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer: Mill specializing in manufacturing specified recyclable carpet tile with a minimum of three years documented experience.
- B. Applicator: Company specializing in carpet installation of the type specified herein with a minimum of three years documented experience, and approved by carpet tile manufacturer.

#### 1.8 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Provide mock-up sample of one room to be designated by Architect, demonstrating the minimum quality of installation for the Work.
- C. Locate mock-ups where directed and include all surfaces scheduled to receive a carpeted finish.
- D. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
- E. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

1.9 ENVIRONMENTAL CONDITIONS

- A. Do not install carpet until areas have been fully enclosed and environmental conditions have reached the levels indicated during occupancy.
- B. Store materials for 3 days (72 hours) prior to installation in area of installation to achieve temperature and humidity stability. Carpet and adhesive must be stored at a minimum temperature of 68 degrees F.
- C. Maintain area of installation at a temperature of at least 68 degrees Fahrenheit, with a relative humidity of between 15 and 65 percent, for a period of 72 hours before, during, and for 72 hours after installation.
  - 1. Ensure surface temperature of carpet substrate is great than 55 degrees Fahrenheit at commencement of carpet tile installation.
- D. Ventilate spaces where work of this Section occurs, during and for a period of 72 hours after completion of curing. Ventilate to dissipate humidity, and to prevent accumulation of fumes, vapors, and gases. Provide temporary fan units and ducting as required to for venting operations

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store all carpeting material under cover in dry, well-ventilated spaces as soon as delivered. Protect carpeting from damage, dirt, stain, moisture, and mildew.
- B. Waste Reduction: Collect polyethylene roll wrap at site and recycle into more roll wrap. Redirect small pieces of waste carpet to be appropriately recycled.

1.11 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
  - 1. Furnish carpet installer's written guarantee covering prompt and proper replacement of any and all carpeting which indicates improper installation workmanship and/or defective material within twelve months from completion of the installation and acceptance thereof by the Architect, said corrective work being performed by the Carpet installer at no cost to the Owner.
  - 2. Furnish carpet manufacturer's warranty which shall contain the following:
    - a. Commencement date for warranty: Date of Project Substantial Completion.
    - b. Wear Warranty - Lifetime of Carpet. No more than 10% face yarn loss by weight in normal use.
    - c. Static Warranty - Lifetime of Carpet.
    - d. Edge Ravel Warranty - Lifetime of Carpet. Guaranteed no edge ravel in normal use (no seam sealers required).
    - e. Delamination Warranty - Lifetime of Carpet. Guaranteed no delamination in normal use (no chair pads required).
    - f. Tuft Bind Warranty - Lifetime of Carpet. Guaranteed not to zipper, wet or dry.

## PART 2 - PRODUCTS

### 2.1 CARPET TILE

- A. General requirements: Carpet tiles, shall conform with or pass tests of the following Standards:
  - 1. ASTM D-2859 (Methenamine Reagent Pill Test).
  - 2. ASTM E-648 (Flooring Radiant Panel Test): Class I (Minimum Average CRF of 0.48).
  - 3. NBS Smoke Chamber Test: Maximum average of 450.
  - 4. AATCC-134 (Electrostatic Propensity): Maximum electrostatic generation below level of human sensitivity.
- B. Carpet tile (designated CPT): Refer to Schedule on Drawings.
- C. Check matching of carpet before installation and ensure there is no visible variation between dye lots.

### 2.2 ACCESSORIES

- A. Filler for patching, smoothing and leveling flooring substrate: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- B. Adhesives for carpet tile: NFPA Class A or UBC Class 1 types, as determined by ASTM E-84 Tunnel Test, as recommended by Carpet manufacturer for application and intended use. Acceptable manufacturers include:
  - 1. Advanced Adhesive Technology, Inc, Dalton GA.
  - 2. DAP Incorporated, Dayton OH.
  - 3. W.W. Henry Company, Aliquippa PA.
  - 4. Macklanburg-Duncan Company, Oklahoma City, OK.
  - 5. Roberts Consolidated Industries, Inc., City of Industry, CA.
- C. Transition strips, carpet reducers, edgings and accessories: Composition nitrile rubber alloy, in colors as selected by the Architect.
  - 1. Acceptable manufacturers:
    - a. American Billtrite (Canada) Ltd., Sherbrooke, Quebec.
    - b. Burke Industries, San Jose, CA.
    - c. Roppe Corporation, Fostoria OH.
    - d. Freudenberg Building Systems Inc., Lawrence MA.
  - 2. Profiles as indicated, submit shop drawings for all conditions not indicated and obtain Architect's approval for each transition/reducer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Ensure that newly placed concrete has cured for a minimum period of 30 days and that moisture content of concrete is within range specified by adhesive manufacturer.
  2. Verify that surfaces are smooth and flat with a maximum variation of 1/4 inch in 10 feet, and are ready to receive work.
  3. Request correction of defects in receiving surfaces which are not correctable by the methods specified herein. Do not commence work until such defects are entirely corrected
  4. Beginning of installation means acceptance of existing substrate and site conditions.
- B. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to Specification Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.

### 3.2 PREPARATION

- A. General: Comply with requirements specified under Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING, the flooring manufacturer's requirements for preparation of substrate to receive resilient flooring, and as additionally specified herein.
- B. Preheat areas to receive carpet to a minimum temperature of 60 degrees F for 72 hours prior to installation, with a relative humidity between 15 and 60 percent. Maintain minimum temperature of 60 degrees F thereafter.
- C. Measure all areas to receive materials to be furnished and installed hereunder, and verify in the field their actual dimensions, including wall-to-wall dimensions, offsets, door locations, and details, fixed equipment, and all other installed items. Extra charges will not be allowed because of lack of familiarity with actual project conditions. Small pieces of carpet will not be acceptable.

### 3.3 INSTALLATION

- A. Install carpet tile in accordance with carpet and adhesive manufacturers' instructions. Immediately notify Architect of conflicts. Cement carpet directly to the substrate with specified installation adhesive. Trowel adhesive evenly on the substrate. Install the carpet within thirty minutes after spreading adhesive.
- B. Lay carpet tile in a square grid pattern, with joints and seams parallel to building lines. Lay joints straight and continuous in both directions and with border carpet tile not less than 1/2 the width of the tile.
1. Install carpet tile using installation pattern (vertical ashlar, horizontal ashlar, quarter turn, herringbone, unidirectional or other), as directed by Architect.
- C. Install specified edging wherever carpeting abuts a dissimilar flooring material, except where wood thresholds, or resilient floor tile trim occurs.

### 3.4 CLEANING

- A. Daily clean work areas by disposing of carpet scraps. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of adhesives and other materials installed under this Section.

- B. Clean and vacuum carpet surfaces upon completion of the installation.

3.5 PROTECTION

- A. General: Protect finished work under provisions of Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- B. Prohibit traffic from carpet areas for 24 hours after installation.
- C. Protect carpet against damage during construction. Cover with not less than 6-mil thick polyethylene covering with taped joints during construction period whenever protection is required, so that carpet will be without any indication of deterioration, wear, or damage at time of completion.
- D. Maintain protection of carpeting on each floor or area until work is accepted.

End of Section

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Section 09 81 00  
ACOUSTICAL INSULATION

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
  - 1. Acoustical insulation as scheduled and where indicated.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing partitions, walls and related insulation.
- D. Section 06 10 00 - ROUGH CARPENTRY: Wood framing, blocking, nailers.
- E. Section 07 21 00 – THERMAL INSULATION.
- F. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING.
- G. Section 09 29 00 - GYPSUM BOARD: Installation of wall board over acoustical insulation.
- H. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Ductwork and piping insulation.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM C 518 - Thermal Transmission Properties by Means of the Heat Flow Meter.
  - 2. ASTM C 553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

3. ASTM C 612 - Mineral Fiber Block and Board Thermal Insulation.
4. ASTM C 665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
5. ASTM E 84 - Surface Burning Characteristics of Building Materials.
6. ASTM E 96 - Water Vapor Transmission of Materials.

## 1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
  2. Certificates:
    - a. Provide manufacturer's written certification of recycled glass content in glass fiber acoustical insulation.
    - b. Provide manufacturer's written certification of recycled slag content in mineral wool insulation.
  3. Sustainable Design Submittals: Indicate post-consumer and pre-consumer recycled content and provide documentation certifying products are from recycled sources.
    - a. Include statement indicating costs for each product having recycled content.
  4. LEED Submittal Requirements:
    - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
      - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
        - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
        - b) EPD shall have at least Cradle to Gate scope,
      - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
    - b. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
      - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
        - a) Itemized vendor invoices for FSC-certified products.
        - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
      - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
    - c. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
      - 1) Recycled Content:

- a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
- b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
- 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
  - a) Documentation should be in the form of one of the following:
  - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
  - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
  - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
  - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
  - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
- 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (insulation):



- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
  - a) The exposure scenario used to determine compliance.
  - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
  - c) Laboratory accreditation under ISO/IEC 17025.
  - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
- 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for flooring systems installed within the waterproofing membrane.

## 1.6 DELIVERY, STORAGE AND HANDLING

### A. Delivery and Acceptance Requirements:

1. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
2. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

### B. Storage and Handling Requirements:

1. Store materials under cover and in manner to keep them dry, protected from weather, direct sunlight and damage from construction traffic and other causes.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

#### A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following:

1. Acoustical glass fiber insulation:
  - a. CertainTeed Corporation, Valley Forge PA.
  - b. Johns Manville Building Insulation, Denver, CO
  - c. Owens Corning Fiberglas Corp., Toledo OH.
  - d. (Goldline brand) Schuller International, Inc., Denver CO.
  - e. USG Corp./ USG Interiors Inc., Chicago IL.
2. Acoustical mineral fiber insulation:
  - a. Fibrex Insulations Inc., Sarnia, Ontario
  - b. Thermafiber Inc., Wabash IN.
  - c. Roxul, Inc., Milton, Ontario.

## 2.2 MATERIALS

- A. Acoustical batt insulation: Mineral wool fiber insulation batts, conforming to ASTM C665 Type 1, and ASTM C553 with a nominal density of 2.5 pounds per cubic foot, nominally 3-1/2 inches thick.
  - 1. Flame Spread Classification: Class A (less than 25, per testing by NFPA 255, ASTM E-84 or UL 723).
  - 2. Recycled content of slag in mineral wool insulation: Use maximum available percentage of material (slag). Mineral wool insulation products incorporated into the work shall contain not less than 75 percent of recycled material (slag) by weight.
  - 3. Acceptable products include:
    - a. Fibrex Insulations Inc. product: "Fibrex Sound Attenuation Fire Batt (SAFB)"
    - b. Roxul, Inc., product "Roxul AFB".
    - c. Thermafiber, Inc. product "Thermafiber SAFB".
- B. Acoustical batt insulation: Unfaced glass fiber insulation nominal 3-1/2 inches [89mm] thick conforming to ASTM C-665 Type I, of width appropriate for spacing of framing or furring members with which used.
  - 1. Flame Spread Classification: Class A (less than 25, per testing by NFPA 255, ASTM E-84 or UL 723).
  - 2. Recycled content of glass in glass-fiber insulation: Use maximum available percentage of recycled glass. Fiber glass insulation products incorporated into the work shall contain not less than 20 percent of recycled glass cullet.

## 2.3 ACCESSORIES

- A. Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each insulation type.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install insulation in accordance with insulation manufacturer's instructions.
- B. Install in interior walls, and ceiling spaces where indicated. Trim insulation neatly to fit spaces. Fit insulation tight in spaces. Leave no gaps or voids.

End of Section

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Section 09 91 00  
PAINTING

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Section Includes: This Section consists of painting work where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Painting work includes, but is not limited to the surface preparation and application of coated finishes, and subsequent touch-up, of interior and exterior items and surfaces as indicated on the Contract Drawings and as scheduled herein.
  - 1. Touch-up work includes touch-up painting after furniture installation and Owner's occupancy. Contractor shall include in its base bid price all costs for touch-up work involving 2 painters for 3 full working days on site.
- B. Surfaces and Materials: In general, without limiting the generality thereof, the following surfaces, fixtures and equipment require a painted finish:
  - 1. New, existing and repaired plaster partition and wall surfaces, ceilings and soffits, including all surfaces disrupted and repaired in the process of installing new building systems and components.
    - 1. Gypsum board partition and wall surfaces, ceilings and soffits.
    - 2. Gypsum plaster partition and wall surfaces, ceilings and soffits.
    - 3. Metal doors and frames.
    - 4. Wood doors and frames.
    - 5. Interior handrails and guardrails.
    - 6. Wood trim.
    - 7. Wood door tops and bottoms, cut in the field, or without factory finish.
    - 8. Factory primed aluminum counter supports.
    - 9. Exposed to view sprinkler piping.
    - 10. Exposed to view electrical conduit and raceways.
    - 11. Exterior galvanized handrails.
    - 12. Elevator ladder, exposed to view lintels and other miscellaneous metal items furnished under Section 05 50 00 - METAL FABRICATIONS which are not factory finished.
    - 13. Access panels and frames.
- C. DO NOT PAINT the following surfaces and materials.

1. Concealed from view surfaces, except as indicated otherwise in the Contract Documents or as specified herein.
2. Chrome or nickel plating, stainless steel, bronze, brass.
3. Aluminum other than mill finished or factory primed.
4. Factory finished mechanical and electrical equipment, pumps, machinery and similar items which occur in mechanical, storage or equipment rooms or areas.
5. Factory finished materials, specialties, and accessories unless otherwise specified.
6. Ceramic tile, terrazzo, acoustical tile, resilient flooring, and other integrally finished floor, wall and ceiling finishes.
7. Prefinished millwork items.
8. Fire resistant testing and certification labels, code required labels, safety warning labels, performance rating plates, nomenclature plates, identification plates, and similar other labels.

### 1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 02 41 19 - SELECTIVE DEMOLITION.
- D. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete partitions and walls.
- E. Section 05 12 00 - STRUCTURAL STEEL FRAMING: Shop priming of structural steel framing.
- F. Section 05 50 00 - METAL FABRICATIONS: Shop priming of designated miscellaneous metals.
- G. Section 06 20 00 - FINISH CARPENTRY: Wood trim items, setting and filling of nails, sanding of wood trim.
- H. Section 07 92 00 - JOINT SEALANTS: Requirements for sealant and backing materials.
- I. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Shop priming of metal frames and steel doors.
- J. Section 08 14 16 - FLUSH WOOD DOORS: Wood doors, both prefinished and unfinished.
- K. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in partitions and walls.
- L. Section 09 29 00 - GYPSUM BOARD: Drywall partitions, ceilings and soffits, including joint treatment and sanding.

- M. Section 10 40 00 - SAFETY SPECIALTIES: Shop priming of cabinet doors and frames; shop finishing of cabinet.
- N. Division 22 - PLUMBING: Prefinished items such as plumbing fixtures, sprinkler heads, convectors, anemostates and similar surfaces and materials.
- O. Division 26 - ELECTRICAL: Prefinished items such as light fixtures, switch gear, electrical distribution cabinets and similar surfaces and materials.
- P. Respective sections: Factory-finishing of food service, mechanical, plumbing, fire protection and electrical equipment.

#### 1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.  
ANSI/ASTM D 16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
  - 1. ASTM D 2016 - Test Method for Moisture Content of Wood.
  - 2. SSPC-Vis1 - Pictorial Surface Preparation Standards for Painting Steel Structures.
  - 3. SSPC-SP2 - Steel Structures Painting Manual, Volume 2, Systems and Specifications.
  - 4. All applicable federal, state and municipal codes, laws and regulations for flammability and smoke generation of interior finishes.
- B. Definitions:
  - 1. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials specified herein, whether used as prime, intermediate or finish coats.
  - 2. Sheen: Specular gloss readings in accordance with ASTM D52.
    - a. Flat: less than 5 (measured at 85 degrees).
    - b. Eggshell: 5 – 20 (measured at 60 degrees).
    - c. Satin: 15-35 (measured at 60 degrees).
    - d. Low Luster: 25 – 35 (measured at 60 degrees).
    - e. Semi-Gloss: 30 -65 (measured at 60 degrees).
    - f. Gloss: 65 or more (measured at 60 degrees).
  - 3. Gloss as defined for LEED VOC requirements. Specified specular gloss readings below are as tested in accordance with ASTM D52.
    - a. Flat: less than 15 (measured at 85 degrees), less than 5 (measured at 60 degrees).
    - b. Non-Flat: greater than 15 (measured at 85 degrees), greater than 5 (measured at 60 degrees).

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. General: The applicator of work specified herein is responsible to ensure that all paints, enamels, and coatings, proposed to be applied hereunder, are compatible with coatings used for shop-primed items and items which have been prime-coated under the work of other trades.
  2. Immediately notify the Architect in writing of conditions which may require a change in the specifications of this Section before proceeding with the work. Failure to do so, in a timely fashion, so as not to interfere with the schedule of work of this Contract, shall be construed as acceptance of the coatings specified. Perform all corrective measures, at no cost to the Owner, for any defects in the work, resulting from the use of such materials.
- B. Scheduling: Painting work should be scheduled so as to minimize touch-ups. Interior painting is to be without flashmarks. Should flashmarks occur due to touch-ups, the Contractor shall be required to redo the entire surrounding wall surface.
- C. Do not order materials until all required schedules have been properly submitted, reviewed by the Contractor and Approved by Architect.

## 1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, material compositions, and application instructions for all finishing products to be applied hereunder.
    - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all paint materials. Submit Green Seal Certification to GS-11 and description of the basis for certification. (LEED Credit EQ 4.2).
    - b. Local/regional materials: Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site. (LEED Credit MR 5.1).
  2. Samples:
    - a. Manufacturer's color selector for custom mixed colors for Architect's color scheduling.
    - b. Opaque coatings: Two 9 x 12 inch finished samples on hardboard of each color scheduled in each finish for review and approval. Identify boards with finish type, color mix number and scheduled substrate surfaces or materials.
    - c. Transparent finishes and stains: Two 9 x 12 inch finished samples on same species of solid wood and plywood to be furnished under Section 06 20 00 - FINISH CARPENTRY, of each color scheduled in each finish for review and approval. Identify boards with finish type, color mix number and scheduled substrate surfaces or materials.
  3. LEED Submittal Requirements:
    - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
      - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
        - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930

- b) EPD shall have at least Cradle to Gate scope,
- 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
  - 1) Recycled Content:
    - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
    - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
  - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
    - a) Documentation should be in the form of one of the following:
    - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
    - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
    - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
    - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
    - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
  - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- c. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:
      - 0.5 mg/m<sup>3</sup> or less;
      - Between 0.5 and 5.0 mg/m<sup>3</sup>; or
      - 5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area



- 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Color chips: After final approval of all colors and tints by the Architect, submit to the Owner, color chips of all coatings used, with manufacturer's name and mix designation of the coating for the purpose of future re-ordering of coatings. Color chips shall be at least six (6) square inches in size, for each color and tint.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
1. Extra Stock Materials: Provide a minimum of one quart container of trim paints and one full gallon container of all other paints and finishes, to the Owner of each color and finish scheduled herein. Label each container with paint mix number, and identify locations where color and tint was used.

#### 1.7 QUALITY ASSURANCE

- A. Applicator: Company specializing in commercial painting and finishing with 3 years minimum documented experience.
- B. Single source responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
- C. Environmental Requirements for Volatile Chemicals:
1. For interior applications use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the following chemical restrictions:
    - a. Flat Paints and Coatings: VOC not more than 50 g/L.
    - b. Non-Flat Paints and Coatings: VOC not more than 150 g/L.
    - c. Anti-Corrosive Coatings: VOC not more than 250 g/L.
    - d. Clear wood finishes:
      - 1) Varnishes: VOC not more than 350 g/L.
      - 2) Lacquer: VOC not more than 550 g/L
    - e. Floor coatings: VOC not more than 100 g/L
    - f. Sealers:
      - 1) Waterproofing sealers: VOC not more than 250 g/L.
      - 2) Sanding sealers: VOC not more than 275 g/L.
      - 3) All other sealers: VOC not more than 200 g/L.
    - g. Stains: VOC not more than 250 g/L.
  2. Do not use water based paints formulated with aromatic hydrocarbons (organic solvent with a benzene ring in its molecular structure), formaldehyde, halogenated solvents, mercury or mercury compounds, or tinted with

pigments of lead, cadmium, chromium VI and their oxides. Water based paints shall be low VOC and shall have a flash point of 61 degrees C or greater.

3. Where it is necessary to use solvent-based paints, with less than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
4. The following shall be low VOC and not be formulated with aromatic hydrocarbons (organic solvent with a benzene ring in its molecular structure).
  - a. High performance water based acrylic coatings.
  - b. Pigmented acrylic sealers.
  - c. Catalyzed epoxy coatings.
  - d. High performance silicone grafted epoxy coatings.
5. Restricted Components: Paints and coatings used on this Project shall not contain any of the following compounds. (Excluded from this restriction are residual quantities of naturally occurring elements and chlorinated organics which are found in chlorinated water supplies; contaminate levels shall be below that of the National Primary Drinking Water Standard):
  - a. 1,2-dichlorobenzene
  - b. Alkylphenol ethoxylates (APEs)
  - c. Formaldehyde-donors
  - d. Heavy metals, including lead, mercury, cadmium, hexavalent chromium and antimony in the elemental form or compounds
  - e. Phthalates
  - f. Triphenyl tins (TPT) and tributyl tins (TBT).

#### 1.8 FIELD SAMPLES

- A. Provide field samples under provisions of Section 01 45 00 - QUALITY CONTROL for purpose of verifying selected colors.
- B. Paint on-site sample areas, minimum 40 square feet, illustrating selected color, and tint.
- C. Locate samples where directed. The Contractor shall provide in the base Contract, a total amount of samples equal to one sample per room.
- D. Accepted samples may not remain as part of the work.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site in sealed and labeled containers; container labeling shall include manufacturer's name, type of paint, color mix designation, expected coverage, surface preparation instructions, instructions for mixing and reducing, drying time, and clean-up recommendations.
- B. Store materials, conforming with applicable codes and fire regulations, in designated spaces. Keep storage area secure when direct access is not required or when not performing work under this Section. Take precautionary measures to prevent fire hazards and spontaneous combustion, maintain a dry-chemical type

fire extinguisher in all areas where materials of this Section are being stored or used.

- C. Store paint materials in a well ventilated area at minimum ambient temperature of 45 degrees Fahrenheit and a maximum of 90 degrees Fahrenheit.
- D. Do not use the sanitary system for mixing or disposal of refuse material. Carry water to mixing rooms and dump waste material in a suitable refuse receptacle. Remove oily rags and waste each day.

#### 1.10 PROJECT CONDITIONS

- A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent unless required otherwise by manufacturer's instructions.
- C. Apply paints and finishes above minimum temperature conditions in strict accordance with manufacturer's instructions.
- D. Provide sufficient lighting to maintain 80 foot-candles measured mid-height at substrate surface.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
  - 1. Paints and general finishes:
    - a. Benjamin Moore & Company, Montvale, NJ.
    - b. California Paints, Andover MA.
    - c. Glidden Professional (division of PPG Industries, Inc.), Strongsville, OH.
    - d. Devoe High Performance Coatings (division of PPG Industries, Inc.), Strongsville, OH.
    - e. Pittsburgh Paints / PPG Industries, Inc., Pittsburgh PA.
    - f. Pratt & Lambert Inc., (division of Sherwin Williams), Buffalo, NY.
    - g. Sherwin Williams, Cleveland OH.
  - 2. Cold galvanizing touch-up paint:
    - a. ZRC Worldwide Inc., Marshfield MA.
    - b. Duncan Galvanizing, Everett, MA.
    - c. Rustoleum Corp., Vernon Hills IL.

## 2.2 MATERIALS

- A. Coatings: Ready mixed, except for field catalyzed coatings with good flow and brushing properties; capable of drying or curing free of streaks or sags. Color pigments shall be processed to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating. Provide best quality grade, where manufacturer makes more than one grade of any material specified.
- B. Liquid zinc coating, for touch-up of welds, scratches, and abrasions in galvanized steel: Low VOC organic zinc-rich coating containing 92% metallic zinc, by weight in the dried film (ASTM D520, Type III) and conforming to SSPC Paint 20, Type II, Level 1. Liquid zinc coating shall be recognized under the Component Program of Underwriter's Laboratories, Inc. as an equivalent to hot-dip galvanizing; conforming to MIL-P-21035B and SSPC Paint 29, Type II, Level I, for repair of hot-dip galvanizing and meeting the requirements for Zinc-Rich Paints.
  - 1. VOC limit: not more than 250 g/L.
  - 2. Specified manufacturer and product: ZRC Worldwide, Marshfield MA, product "ZRC-221".

## 2.3 ACCESSORIES

- A. Accessory materials: other materials not specifically indicated, but are required to achieve the finishes specified of commercial quality.
- B. Cleaning Materials: Tri-Sodium Phosphate (TSP) substitute. Acceptable products include the following, or approved equal:
  - 1. Savogran, Norwood MA, products "TSP-PF", or "Liquid TSP Substitute".
  - 2. Custom Building Products, Seal Beach, CA., product "Custom T.S.P. Substitute".
  - 3. DAP Inc., Baltimore MD., product "T.S.P. Substitute Heavy Duty Cleaner".

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify Contractor of any condition that may potentially affect proper application of coatings.
- B. Measure moisture content of surfaces, do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Gypsum board and joint treatment: 12 percent.
  - 2. Gypsum plaster: 12 percent.
  - 3. Portland Cement plaster: 15 percent.
  - 4. Interior wood: 15 percent.
  - 5. Exterior wood: 18 percent.
- C. Beginning Work of this Section means acceptance of existing substrate surfaces and site conditions.

### 3.2 PREPARATION

- A. Furnish and lay suitable drop cloths in all areas where coating work is being done to protect floors and all other surfaces from damage during the work. Protect adjoining surfaces with painters mask tape.
- B. Prior to preparing surfaces or finishing, remove all finish hardware for painting doors and frames, except hinges and locks on exterior door; remove electrical plates, light fixture trim and fittings. Re-install hardware and other removed items after painted surfaces are thoroughly dry.
- C. Mix coatings thoroughly, unless otherwise directed by the manufacturer of the specific coating used, to ensure uniformity of color and mass. Strain previously opened coatings to remove skins, lumps, and other foreign matter prior to painting.
- D. Thin or reduce materials only as recommended by the specific material manufacturer, and only with the approval of the Architect.
- E. Impervious surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to thoroughly dry.
- F. Uncoated steel and iron surfaces:
  - 1. Remove grease, scale, dirt, rust, and all foreign materials, down to bright metal by wire brushing, scraping, sanding, or sandblasting where heavy coatings of scale are evident.
  - 2. Wash steel with solvent, apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned.
  - 3. Spot prime after repairs with metal primer product of the finish coating manufacturer.
- G. Shop primed steel surfaces:
  - 1. Remove rust, blistered and defective shop prime paint, and all foreign materials, down to bright metal by wire brushing, scraping, sanding, or commercial paint remover. Feather edges to make touch-up patches inconspicuous.
  - 2. Remove all grease or dirt with mineral spirits.
  - 3. Spot prime bare metal with metal primer product of the finish coating manufacturer. Seal top and bottom edges of metals doors with primer.
- H. Previously painted steel surfaces:
  - 1. Remove rust, blistered and defective paint, down to bright metal by wire brushing, scraping, or sanding. Feather edges to make touch-up patches inconspicuous as possible
  - 2. Remove grease, dirt and all foreign materials.
  - 3. Spot prime bare metal with metal primer product of the finish coating manufacturer.
- I. Previously painted surfaces to receive wall covering:
  - 1. Sand with 320 grit waterproof paper until surfaces are uniformly abraded.
- J. New galvanized surfaces to receive field apply paint:

1. Prepare surfaces in accordance with SSPC-SP16 to achieve a surface profile of 0.5 to 1.5 mils.
- K. Existing galvanized metal surfaces which have been depleted of zinc by exposure or abrasion to receive touch-up liquid zinc coating.
1. Thoroughly abrade surface to be coated with wire brush to remove rust and loose materials
  2. Clean surface with industrial solvent to remove dirt, grease and oils.
- L. Aluminum surfaces scheduled for paint finish:
1. Remove surface contamination by steam or high pressure water.
  2. Remove oxidation with acid etch and solvent washing.
  3. Apply etching primer immediately following cleaning.
- M. New interior wood items scheduled to receive field-applied transparent finish.
1. Sand all exposed surfaces by hand or by steel orbital sander. Begin sanding using 100 grit to 120 grit paper, working to finer sandpaper for subsequent sanding with 220 grit paper.
  2. Fill up nail holes and cracks with stainable wood filler. Sand smooth excess filler.
  3. Remove all dust on surface immediately prior to finishing using HEPA vacuum followed by wiping with damp cloth.
- N. New interior wood items scheduled to receive paint (opaque) finish.
1. Smooth minor defects and remove all foreign matter by sanding, and if necessary, steel wool.
  2. Wash sap spots and knots with mineral spirits. When dry, touch up knots, pitch streaks, and sappy sections with commercial stain sealer.
  3. Fill up nail holes and cracks with wood putty or plastic wood after primer of first coat of finish is dry, and sand smooth.
- O. Existing interior wood items scheduled to receive paint finish.
1. Smooth minor defects by sanding. Remove all foreign matter with mineral spirits and fine sandpaper or steel wool.
  2. Touch up knots and pitch streaks with commercial stain sealer.
  3. Fill up nail wood defects, chips in layers of paint, and cracks with spackle. Ease edges of existing paint by application of spackle and sanding smooth.
- P. New exterior wood scheduled to receive paint finish.
1. Smooth minor defects by sanding and/or by the use of steel wool. Remove all foreign matter with commercial paint remover and fine sandpaper.
  2. Treat wood with a dip or heavy flood coat of Water Repellant Wood Preservative, allow to dry. Touch up knots, pitch streaks, and sappy sections with commercial stain sealer.
  3. Fill up nail holes and cracks with wood putty or plastic wood after primer of first coat of finish is dry, and sand smooth.

- Q. Gypsum board surfaces, new and existing: Fill minor defects with latex based spackle. Spot-seal all compound surfaces and repair areas in gypsum board, with specified first coat material before application of the first coat.
- R. Plaster surfaces, new and existing:
  - 1. Fill minor defects with joint compound or spackle and seal with primer.
  - 2. Cracks in plaster: Gouge minor cracks to 1/16 inch in width and depth and fill with type "AP" sealant as specified under Section 07 92 00 - JOINT SEALERS.

### 3.3 APPLICATION

- A. Apply all materials in strict accordance with the approved manufacturer's printed instruction, and in accordance with the best trade practices. Each coat shall be reviewed and approved by the Architect before succeeding coats are applied.
- B. Do not apply successive coating until the preceding coat is thoroughly dry, and in no case in less than 24 hours after the preceding coat.
- C. Number of coats is indicated under Painting Schedules. Number of coats is indicated as a minimum number to be applied over scheduled substrates. An additional coat or coats may be required for proper color coverage of substrate as determined by the Architect, at no additional cost to the Owner. Examples of these conditions include, but are not limited to:
  - 1. Dark colored substrates may require an additional primer or intermediate coat to stabilize color, if final applied top-coat color is light.
  - 2. Pre-finished or pre-primed products may require an additional field applied coat to stabilize the shop/factory applied base color prior to application of top-coat finishes.
  - 3. Dark color top coat finishes may require additional finish coat over white or light colored substrates to obtain correct color density.
- D. Apply each coat to a uniform finish; Apply primer and first coat of slightly lighter in color tint than the scheduled color of the final coat.
- E. Sand lightly between coats to achieve required finish and remove sanding dust prior to applying succeeding coat.
- F. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- G. Prime back surfaces of all interior and exterior woodwork scheduled for painted finish with primer.
- H. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

### 3.4 CLEANING

- A. Upon completion of the work in each area, remove all coating splatters from glass, prefinished surfaces, bright metals, and from other surfaces that have not been painted or finished hereunder. Do not use abrasive paper or abrasive cleaner on any prefinished surface or bright metal. Remove all materials and debris; leave work area in a clean condition.

3.5 PROTECTION AND TOUCH-UP

- A. During painting work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Properly clean, repair or replace any work so damaged and soiled.
- B. Protect all painted and finished surfaces against damage until the date of final acceptance of the work. The Architect will conduct a final review of all work performed hereunder. Re-coat or touch-up, all scratches and other blemishes on surfaces, and as directed by the Architect, any areas found which do not comply with the requirements of this Section, and bear all costs therefore.
- C. Any re-coating or touch-up work, required after the work of this Section has been reviewed and accepted by the Architect, will be paid for by the Contractor.

3.6 PAINTING SCHEDULE

- A. Colors: The Architect will furnish a schedule of colors for each area and surface. Tinting and matching shall be to the satisfaction of the Architect. No limit is placed on the number of colors that may be required, or the number of colors in any one room, area, or surface. Premium paints of deep-hued, bright, pigment intensive, accent and primary colors may be scheduled for up to 25 percent of all interior and exterior surfaces without additional cost to the Owner.
  - 1. Colors of priming coats (and body coats where specified) shall be lighter in tint than those of finish coat.
  - 2. Colorants: Pure, non-fading pigments, mildew-proof, ultra-violet resistant, finely ground in approved medium; and be limeproof, when used in coatings to be applied on masonry, concrete, plaster, and gypsum board surfaces.
- B. Paint schedule for exterior surfaces and materials: Refer to Document 09 91 13.
- C. Paint schedule for interior surfaces and materials: Refer to Document 09 91 23.
- D. Paint schedule for labeling and identifying fire resistive and rated designations : Refer to Document 09 91 23.
- E. Painting schedule for mechanical and electrical equipment: Refer to Document 09 91 23.

End of Section



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Section 09 91 13  
EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope of work: Work of this Section includes surface preparation and painting of new and existing exterior elements and assemblies, including but not limited to the following.
  - 1. Wood trim, clear-finished.
  - 2. Metal doors, painted.
  - 3. Wood trim at dormers, painted.
  - 4. Wood deck at canopy, clear-finished.
  - 5. Other ferrous metal items such as guards, handrails, gratings, and the like.
- B. Presence of lead: The contractor shall assume that all window sash and painted surfaces contain lead, and shall meet all applicable requirements for worker protection, safe operations, and proper disposal of all materials.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
  - 1. Requirements related to hazardous building materials including but not limited to asbestos are indicated in Division 02 Section ASBESTOS ABATEMENT.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
  - 2. Step coats on Samples to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
  - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
  - 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted, unless otherwise noted.
  - 3. VOC content.
- E. Submit the following under provisions of Section 01 33 00 - Submittal Procedures:

1. LEED Submittal Requirements:
  - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
    - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
      - a) a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
      - b) b) EPD shall have at least Cradle to Gate scope,
    - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
    - 3) Recycled Content:
      - a) a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
      - b) b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
    - 4) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
      - a) a) Documentation should be in the form of one of the following:
        - b) b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
        - c) c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
        - d) d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
        - e) e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
        - f) f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
    - 5) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an HPD.

### 1.3 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. Paint: Five gallons of each material and color applied.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List," unless otherwise noted.
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated, unless otherwise noted.

B. Single Source: Provide all paint materials from a single manufacturer source.

C. Applicator qualifications: A firm experienced in applying paints and coatings similar in material, design and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

D. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
  - a. Vertical and Horizontal Surfaces: Provide samples of at least 20 sq. ft. (9 sq. m).
  - b. Window: Architect will designate one window for paint mockup.
  - c. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
  - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 REGULATORY / SAFETY REQUIREMENTS

- A. Some existing painted surfaces may contain lead-based paint. Conform to applicable codes and regulations for the protection of workers and the handling and disposal of lead-containing paint residue. Provide mechanical ventilation, fire extinguishers, protective clothing and other measures as required for conformance to applicable codes and regulations.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

#### 1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

### PART 2 - PRODUCTS

#### 2.1 LEED REQUIREMENTS

- A. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
  1. Provide products with Third Party Environmental Product Declaration (EPD) whenever possible.
- B. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
  1. Provide products with publicly available material inventories whenever available.

#### 2.2 SURFACE PREPARATION PRODUCTS

- A. For Existing Wood or Ferrous Metal:
  1. Sandpaper: Garnet, 60 to 120 grade.
  2. Tools: Paint scrapers, putty knives, and electric vibrating sanders. Belt sanders may be used only after specific approval from the Architect. Contractor must demonstrate skillful use of belt sander on sample area.
- B. For New Wood:
  1. Wood Filler: Plastic wood filler or wood putty; Contractor shall submit product data.
  2. Wood Knot Sealer: Benjamin Moore Speedy Primer Sealer No 340, or approved equal.

#### 2.3 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, unless otherwise noted:
  1. Benjamin Moore & Co.
  2. ICI Paints.
  3. Pratt & Lambert.
  4. Sherwin-Williams Company (The).

2.4 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List," unless otherwise noted.
- B. Material Compatibility:
  - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As selected by Architect from full range of any listed manufacturer, including deep tones.

2.5 METAL PRIMERS

- A. Primer, Anti-Corrosive for Metal: Zinc rich coating
  - 1. Products: Subject to compliance with requirements, provide ZRC Worldwide; Cold Galvanizing Compound.

2.6 WOOD PRIMERS

- A. Exterior Latex Wood Primer: MPI #6.

2.7 EXTERIOR LATEX PAINTS

- A. Exterior Latex; gloss as indicated in Part 3, MPI #15.

2.8 MATERIALS AND PRODUCTS FOR EXTERIOR STAIN AND CLEAR FINISH

- A. Solvents
  - 1. Mineral Spirits: As manufactured by Ashland Chemical, Inc., Carteret, NJ, or approved equal.
  - 2. Odorless Paint Thinner: 100 percent petroleum distillate, mineral spirits. Provide U.S. Paint Thinner, as manufactured by Recochem Inc., Montreal, Quebec, or approved equal.
  - 3. Turpentine: Pure gum spirits of turpentine complying with requirements of ASTM D 13.

- B. Dye: Non-grain-raising dye produced using water-soluble powder in color or colors required to match original tint. Provide Lockwood's Stain, manufactured by W. D. Lockwood & Co. Inc., 81-83 Franklin St., New York, NY 10013 (212) 966-4046.
- C. Paste Wood Filler: Provide "Benwood Wood Grain Filler 238" as manufactured by Benjamin Moore and Co., or approved equal. Tint filler to match wood to be filled.
- D. Wood Stain: "Concentrated Colors," manufactured by Sutherland Welles, Ltd., P.O. Box 180, North Hyde Park, VT 05665 (800-322-1245). Mix colors as required to provide stain matching adjacent wood.
- E. Wood Sealer: Solution of polymerized tung oil and urethane resin specifically formulated to be wiped on wood surfaces as preparation for a wiping varnish. Provide "Wiping Varnish Sealer," manufactured by Sutherland Welles, Ltd., P.O. Box 180, North Hyde Park, VT 05665 (800-322-1245).
- F. Oil Varnish: Solution of polymerized tung oil with urethane resin specifically formulated to be wiped on wood surfaces and to provide a semigloss finish. Provide "Medium Lustre Wiping Varnish," as manufactured by Sutherland Welles, Ltd., (800) 322-1245, or approved equal.
- G. Abrasives for Rubbing Out Finishes: System of graded abrasives with finest grade sufficient to produce required sheen.
  - 1. Dry Abrasives: Pumice; rotten stone.
  - 2. Microabrasive Papers: Stearated sheets specifically for use on coatings. Provide up to 1600 grit.
  - 3. Paste Abrasive Compounds: Premixed pastes containing abrasives, manufactured specifically for use on coatings. Provide "Rubbing Compound" and "Polishing Compound."

## 2.9 PAINT SYSTEMS FOR EXTERIOR OPAQUE FINISH ON FERROUS METAL

- A. Provide the following paint system or approved equal:
  - 1. Benjamin Moore and Company, 51 Chestnut Ridge Rd., Montvale, NJ 07645.
    - a. Primer (Coat 1): "Fresh Start Moorwhite Penetrating Alkyd Primer 100"
    - b. Finish Coats (Coats 2 and 3): "Aura Waterborne Exterior Semi-Gloss Finish 632"

## 2.10 PAINT SYSTEMS FOR EXTERIOR OPAQUE FINISH ON WOOD

- A. Provide latex paint system as follows below, or approved equal:
  - 1. Benjamin Moore and Company, 51 Chestnut Ridge Rd., Montvale, NJ 07645.
    - a. Primer (Coat 1): "Ultra Spec Exterior Latex Primer"
    - b. Finish Coats (Coats 2 and 3): "Ultra Spec Exterior Satin Paint"

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION, GENERAL

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
  - 1. SSPC-SP 2, "Hand Tool Cleaning."
  - 2. SSPC-SP 3, "Power Tool Cleaning."
  - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
  - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.



### 3.3 PREPARATION OF WOOD SURFACES

- A. Preparation of New Wood:
1. Remove dust by brushing and remove grease and oil by washing with mineral spirits or other solvent. Remove sap on wood surfaces by scraping and washing with turpentine. Sand surfaces exposed to view smooth and dust off.
  2. Seal all knots or resinous areas with knot sealer and allow to dry at least 2 hours before priming. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
  3. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
  4. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
  5. Back prime backs, edges, and ends of all exterior wood.
- B. Preparation of Existing Painted Wood:
1. Preparation of existing wood doors is specified in Section 08212. Preparation of existing wood windows and frames is specified in Section 08550.
  2. Remove loose, flaked, curled, and deeply creased paint on existing surfaces to sound surface using hand scrapers only.
    - a. Sand surfaces to sound paintable surface by hand or mechanical vibrating sander only. The use of rotary disk sanders will not be permitted.
    - b. Feather by sanding rough paint layer edges.
    - c. Total removal of sound paint coatings is not required, but prepared surfaces must be sound and smooth, free of blunt edges, cracks and alligating.
  3. Spot prime sanded areas of bare wood.
  4. After required spot priming, fill all gaps, holes and depressions with wood filler; sand flush and smooth.
  5. Clean surfaces of dust by blowing with dry compressed air or by thoroughly sweeping.

### 3.4 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
  2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  3. Paint entire exposed surface of window frames and sashes.
  4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Paint the following work where exposed to view:
    - a. Equipment, including panelboards and switch gear
    - b. Uninsulated metal piping.
    - c. Pipe hangers and supports.
    - d. Metal conduit.
    - e. Tanks that do not have factory-applied final finishes.

### 3.5 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
  - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
  - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

### 3.6 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.7 EXTERIOR PAINTING SCHEDULE

- A. Ferrous Metal:

1. Alkyd System:
  - a. Prime Coat(s): Rust inhibiting alkyd primer; number of coats per manufacturer's recommendations; touch up shop primed items.
  - b. Intermediate Coat: Exterior latex matching topcoat.
  - c. Topcoat: Exterior latex, gloss 5.
  
- B. Wood Substrates:
  1. Sealer and Varnish System, medium sheen:
    - a. Exterior sealer; let cure 12-24 hours, then sand 400 grit, vacuum and tack surface.
    - b. Second coat exterior sealer, repeat previous step except sand 600 grit.
    - c. First coat Exterior Medium Lustre Tung Oil; let cure 24 hours, then sand 600 grit, vacuum and tack surface.
    - d. Finish coat Exterior Medium Lustre Tung Oil.
  
  2. Opaque Latex System, medium sheen:
    - a. Exterior primer; let cure 12-24 hours, then sand 400 grit, vacuum and tack surface.
    - b. Second coat primer, repeat previous step except sand 600 grit.
    - c. First coat finish paint; let cure 24 hours, then sand 600 grit, vacuum and tack surface.
    - d. Finish coat.

End of Section

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Document 09 91 23  
INTERIOR PAINTING SCHEDULE

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.
- C. General: Number of coats scheduled herein below is minimum required, refer to Article entitled "APPLICATION" in specification Section 09 91 00 - PAINTING, regarding coverage.

1.2 MANUFACTURER'S DESIGNATIONS

- A. Manufacturer's designations used in Schedule are defined as follows:
  - 1. "Moore": Benjamin Moore & Company, Montvale, NJ.
  - 2. "California": California Paints, Andover MA.
  - 3. "Carboline": Carboline, Inc., St. Louis MO.
  - 4. "Con-Lux": Con-Lux Coatings Inc. (division of Sherwin Williams), Edison NJ.
  - 5. "Devoe": Devoe High Performance Coatings (division of PPG Industries, Inc.), Strongsville, OH.
  - 6. "Duron": Duron Paints (division of Sherwin Williams), Alexander VA.
  - 7. "Dunn": Dunn-Edwards Corporation, Los Angeles, CA.
  - 8. "Glidden": Glidden Professional (division of PPG Industries, Inc.), Strongsville, OH.
  - 9. "International": International Paint LLC (Division of Akzo Nobel), Forth Worth TX.
  - 10. "Porter": Porter Paints (division of PPG Industries, Inc.), Pittsburgh PA.
  - 11. "PPG": Pittsburgh Paints / PPG Industries, Inc., Pittsburgh PA.
  - 12. "Sherwin Williams": Sherwin Williams, Cleveland OH.
  - 13. Tnemec": Tnemec Company, Inc., Kansas City, MO.
  - 14. "Vimasco": Vimasco Corporation, Nitro WV.

1.3 PAINTING SCHEDULE FOR INTERIOR SURFACES AND MATERIALS

- A. Interior underside of DECKING AND SLABS, which are exposed to view, including exposed to view joists, overhead steel, sprinkler piping, conduits, ducts and similar items:
  - 1. Two coats waterborne acrylic dry fall finish:
    - a. California: "Economy Latex Dry Fall Spray Flat", N<sup>o</sup>. 3701.
    - b. Glidden Professional: Waterborne Dry Fall Flat N<sup>o</sup> 1280.

- c. Moore: "Coronado Late Dry Fall Flat N110.
  - d. Pittsburgh: "Speedhide Latex Dry Fog Spray Paint", 6-714/715 Series.
  - e. Sherwin-Williams: "Pro Industrial Waterboarne Acrylic Dryfall, Flat", B42 Series.
- B. Interior EXPOSED DUCTWORK, Insulated and Wrapped
- 1. Apply one prime coat and two finish coats of a paint recommended by the approved paint manufacturer for application on the exposed wrapping material.
- C. Interior GYPSUM BOARD (drywall) partitions and walls, previously painted:
- 1. Two coats eggshell paint:
    - a. California: "Elements 100% Acrylic Zero VOC Eggshell", N°. 731.
    - b. Glidden Professional: Lifemaster No VOC Eggshell N°. 9300.
    - c. Moore: "Ultra Spec 500 Low Sheen Eggshell N537.
    - d. Pittsburgh: "Pure Performance Eggshell", N°. 9-300.
    - e. Sherwin-Williams: "Harmony Low Odor Interior Latex Eg-Shel", B9 Series".
- D. Interior GYPSUM BOARD (drywall) partitions:
- 1. One coat latex primer.
    - a. California: "Elements 100% Acrylic White Primer", N°. 74600.
    - b. Glidden Professional: Lifemaster No VOC Primer N°. 9116.
    - c. Moore: "Ultra Spec 500 Interior Latex Primer", N°. N534.
    - d. Pittsburgh: "Pure Performance Interior Latex Primer", N°. 9-900.
    - e. Sherwin-Williams: "Harmony Interior Latex Primer", B11W900 Series.
  - 2. Two coats eggshell paint:
    - a. California: "Elements 100% Acrylic Zero VOC Eggshell", N°. 731.
    - b. Glidden Professional: Lifemaster No VOC Eggshell N°. 9300.
    - c. Moore: "Ultra Spec 500 Low Sheen Eggshell N537.
    - d. Pittsburgh: "Pure Performance Eggshell", N°. 9-300.
    - e. Sherwin-Williams: "Harmony Low Odor Interior Latex Eg-Shel", B9 Series".
- E. Interior GYPSUM BOARD (drywall) partitions, and ceilings, at toilet rooms, janitor's closets, food preparation and dishwashing areas where indicated to receive an epoxy painted finish:
- 1. One coat of sealer,
    - a. California: "Prime Choice ASAP Primer", N°. 50300.
    - b. Glidden Professional: Gripper Primer N°. 3210.
    - c. Moore: "Ultra Spec 500 Primer N534.
    - d. Pittsburgh: "Speedhide Interior Quick Drying Latex Sealer", 6-2 Series.
    - e. Sherwin-Williams: "ProMar 200 Zero VOC Interior Latex Primer", B28w2600 Series.

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- f. Tnemec: PVA 51-792 Sealer.
  2. Two coats of semi-gloss Water Based Acrylic-Epoxy Coatings (3 mils DFT each coat).
    - a. California: No equivalent.
    - b. Devoe Coatings: Tru-Glaze-WB" 4418 Waterborne Acrylic Epoxy Coating.
    - c. Moore: "Corotech Water Based (WB) Epoxy, V450 series.
    - d. Pittsburgh: "Pitt-Glaze Water Based Acrylic Epoxy Enamels", 16 Series.
    - e. Sherwin-Williams: "Pro industrial Water Based (WB) Epoxy" B73 Series.
    - f. Tnemec: "Tneme-Tufcoat", N°. 112.
  - F. Interior GYPSUM BOARD (drywall) ceilings and underside of soffits, previously painted:
    1. Two coats flat paint:
      - a. California: "Elements Zero VOC Flat 100% Acrylic", N°. 733.
      - b. Glidden Professional: Lifemaster No VOC Flat N°. 9100.
      - c. Moore: "Ultra Spec 500 Latex Flat N536.
      - d. Pittsburgh: "Pure Performance, Flat", 9-100 Series.
      - e. Sherwin-Williams: "Harmony Low Odor Interior Latex Flat", B5 Series.
  - G. Interior GYPSUM BOARD (drywall) ceilings and underside of soffits:
    1. One coat latex primer.
      - a. California: "Elements 100% Acrylic White Primer", N°. 74600.
      - b. Glidden Professional: Lifemaster No VOC Primer N°. 9116.
      - c. Moore: "Ultra Spec 500 Primer N534.
      - d. Pittsburgh: "Pure Performance Interior Latex Primer", N°. 9-900.
      - e. Sherwin-Williams: "Harmony Interior Latex Primer", B11W900 Series.
    2. Two coats flat paint:
      - a. California: "Elements Zero VOC Flat 100% Acrylic", N°. 733.
      - b. Glidden Professional: Lifemaster No VOC Flat N°. 9100.
      - c. Moore: "Ultra Spec 500 Latex Flat N536.
      - d. Pittsburgh: "Pure Performance, Flat", 9-100 Series.
      - e. Sherwin-Williams: "Harmony Low Odor Interior Latex Flat", B5 Series.
  - H. Interior GYPSUM PLASTER partitions and walls, previously painted:
    1. Two coats latex eggshell paint:
      - a. California: "Elements 100% Acrylic Zero VOC Eggshell", N°. 731.
      - b. Glidden Professional: Lifemaster No VOC Eggshell N°. 9300.
      - c. Moore: "Ultra Spec 500 Low Sheen Eggshell N537.
      - d. Pittsburgh: "Pure Performance Eggshell", N°. 9-300.
      - e. Sherwin-Williams: "Harmony Low Odor Interior Latex Eg-Shel", B9 Series".

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- I. Interior GYPSUM PLASTER partitions and walls:
    - 1. One coat primer.
      - a. California: "Elements 100% Acrylic Zero VOC Eggshell", N°. 731.
      - b. Glidden Professional: Lifemaster No VOC Eggshell N°. 9300.
      - c. Moore: "Ultra Spec 500 Interior Low Sheen Eggshell N537.
      - d. Pittsburgh: "Pure Performance Eggshell", N°. 9-300.
      - e. Sherwin-Williams: "Harmony Low Odor Interior Latex Eg-Shel", B9 Series".
    - 2. Two coats latex eggshell paint:
      - a. California: "Elements 100% Acrylic Zero VOC Eggshell", N°. 731.
      - b. Glidden Professional: Lifemaster No VOC Eggshell N°. 9300.
      - c. Moore: "Ultra Spec 500 Low Sheen Eggshell N537.
      - d. Pittsburgh: "Pure Performance Eggshell", N°. 9-300.
      - e. Sherwin-Williams: "Harmony Low Odor Interior Latex Eg-Shel", B9 Series".
  - J. Interior GYPSUM PLASTER, ceilings, and underside of soffits, previously painted:
    - 1. Two coats latex flat paint:
      - a. California: "Elements Zero VOC Flat 100% Acrylic", N°. 733.
      - b. Glidden Professional: Lifemaster No VOC Flat N°. 9100.
      - c. Moore: "Ultra Spec 500 Latex Flat N536.
      - d. Pittsburgh: "Pure Performance, Flat", 9-100 Series.
      - e. Sherwin-Williams: "Harmony Low Odor Interior Latex Flat", B5 Series.
  - K. Interior GYPSUM PLASTER, ceilings, and underside of soffits:
    - 1. One coat primer.
      - a. California: "Elements 100% Acrylic Zero VOC Eggshell", N°. 731.
      - b. Glidden Professional: Lifemaster No VOC Eggshell N°. 9300.
      - c. Moore: "Ultra Spec 500 Interior Low Sheen Eggshell N537.
      - d. Pittsburgh: "Pure Performance Eggshell", N°. 9-300.
      - e. Sherwin-Williams: "Harmony Low Odor Interior Latex Eg-Shel", B9 Series".
    - 2. Two coats latex flat paint:
      - a. California: "Elements Zero VOC Flat 100% Acrylic", N°. 733.
      - b. Glidden Professional: Lifemaster No VOC Flat N°. 9100.
      - c. Moore: "Ultra Spec 500 Latex Flat N536.
      - d. Pittsburgh: "Pure Performance, Flat", 9-100 Series.
      - e. Sherwin-Williams: "Harmony Low Odor Interior Latex Flat", B5 Series.
  - L. Interior METAL, ALUMINUM, shop primed and previously painted (includes counter supports):
    - 1. Touch up bare metal with latex metal primer.

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- a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
  - b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
  - c. Moore: "Metal Primer", N°. P04.
  - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish 100% Acrylic", 90-709/712 Series.
  - e. Sherwin-Williams: "DTM Acrylic Primer Finish", B66 W11 Series.
2. Two coats acrylic semi-gloss enamel:
    - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
    - b. Devoe Coatings: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
    - c. Moore: "Ultra Spec 500 DTM Acrylic Semi-Gloss", N°. HP29.
    - d. Pittsburgh: "Pitt-Tech Plus High Performance, Semi -Gloss DTM Industrial Enamel", 90-1210 Series.
    - e. Sherwin-Williams: "Sher-Cryl HPA Semi-Gloss", B66 Series.
- M. Interior METAL, FERROUS, excluding railings, to receive semi-gloss finish:  
(includes galvanized metal doors and frames):
1. One coat of rust prohibitive primer for unfinished metal surfaces, and touch up bare metal at shop primed, existing and previously coated surfaces:
    - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
    - b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
    - c. Moore: "Acrylic Metal Primer", N°. P04.
    - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish 100% Acrylic", 90-709/712 Series
    - e. Sherwin-Williams: "DTM Acrylic Primer Finish", B66 W1 Series.
  2. Two coats acrylic semi-gloss enamel:
    - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
    - b. Devoe Coatings: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
    - c. Moore: "Ultra Spec 500 DTM Acrylic Semi-Gloss", N°. HP29.
    - d. Pittsburgh: "Pitt-Tech Plus High Performance, Semi -Gloss DTM Industrial Enamel", 90-1210 Series.
    - e. Sherwin-Williams: "Sher-Cryl HPA Semi-Gloss", B66 Series.
- N. Interior METAL, GALVANIZED, (includes exposed ductwork):
1. Touch-up with metal primer.
    - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
    - b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
    - c. Moore: "Acrylic Metal Primer", N°. P04.
    - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish 100% Acrylic", 90-709/712 Series.
    - e. Sherwin-Williams: "DTM Acrylic Primer Finish" B66 W1 Series.
  2. Two coats acrylic semi-gloss enamel:



- a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
  - b. Devoe Coatings: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
  - c. Moore: "Ultra Spec 500 DTM Acrylic Semi-Gloss", N°. HP29.
  - d. Pittsburgh: "Pitt-Tech Plus High Performance, Semi -Gloss DTM Industrial Enamel", 90-1210 Series.
  - e. Sherwin-Williams: "Sher-Cryl HPA Semi-Gloss", B66 Series.
- O. Interior exposed METAL, PIPING: Same as specified for ferrous metal.
- P. Interior METAL, RAILINGS (handrails and guardrails):
- 1. One coat of epoxy primer (dry film coat 3.0 to 4.0 mils)
    - a. Devoe Coatings: Tru-Glaze-WB" 4030 Waterborne Epoxy Primer
    - b. Moore: "Coronado Rust Scat Acrylic Primer 36.
    - c. Pittsburgh: "Aquapon WB Epoxy Primer", 98 Series
    - d. Sherwin-Williams: "Pro Industrial Pro-Cryl Universal Primer", B66-310 Series.
  - 2. Two coats of gloss finish epoxy coating (dry film coat 2.5 to 3.0 mils).
    - a. Devoe Coatings: Tru-Glaze-WB 4408 Waterborne Gloss Epoxy Coating.
    - b. Moore: "Corotech Water-Based Epoxy", V450 Series.
    - c. Pittsburgh: "Aquapon WB Epoxy Coatings", 98 Series.
    - d. Sherwin-Williams: "Pro Industrial Waterbased Epoxy, B70W211/B60V15 Series".
- Q. Interior WOOD DOORS, shop primed and previously painted to receive painted (opaque) finish:
- 1. Touch up bare wood with acrylic stain-blocking primer-sealer (undercoater):
    - a. California: "Wipe-Out 100% Acrylic Latex Stain Block", N° 52500.
    - b. Glidden: Wall and Woodwork Primer Sealer, N° 1020.
    - c. Moore: "Fresh Start High-Hiding All Purpose Primer, N° 046.
    - d. Pittsburgh: "Seal Grip Interior/Exterior Universal Primer/Sealer", 17-921 series.
    - e. Sherwin-Williams: "Preprite ProBlock", B51 W620 Series.
  - 2. Two coats acrylic semi-gloss enamel:
    - a. California: "Fres-Coat Unite Semi-Gloss", N°. 563.
    - b. Glidden Professional: Ultra Hide 150 Semi-Gloss N°. 1416.
    - c. Moore: "Ultra Spec 500 Latex Semi Gloss N539.
    - d. Pittsburgh: "Speedhide Interior Semi-Gloss", N°. 6-55.
    - e. Sherwin-Williams: "ProMar 200 Zero VOC Semi-Gloss", B31-2600 Series.
- R. Interior WOOD TRIM, new, unfinished, to receive painted (opaque) finish:
- 1. One coat acrylic stain-blocking primer-sealer (undercoater):
    - a. California: "Wipe-Out 100% Acrylic Latex Stain Block", N° 52500.

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- b. Glidden: Wall and Woodwork Primer Sealer, N° 1020.
  - c. Moore: "Fresh Start High-Hiding All Purpose Primer, N° 046.
  - d. Pittsburgh: "Seal Grip Interior/Exterior Universal Primer/Sealer", 17-921 series.
  - e. Sherwin-Williams: "PrepRite ProBlock Primer/Sealer", B51 W620 Series.
2. Two coats acrylic semi-gloss enamel:
- a. California: "Fres-Coat Unite Semi-Gloss", N°. 563.
  - b. Glidden Professional: Ultra Hide 150 Semi-Gloss N°. 1416.
  - c. Moore: "Ultra Spec 500 Latex Semi Gloss N539.
  - d. Pittsburgh: "Speedhide Interior Semi-Gloss", 6-500 Series.
  - e. Sherwin-Williams: "ProMar 200 Zero VOC Semi-Gloss", B31-2600 Series.
- S. Interior WOOD TRIM, shop primed and previously painted, to receive painted (opaque) finish:
1. Touch up bare wood with acrylic stain-blocking primer-sealer (undercoater):.
- a. California: "Wipe-Out 100% Acrylic Latex Stain Block", N° 52500.
  - b. Glidden: Wall and Woodwork Primer Sealer, N° 1020.
  - c. Moore: "Fresh Start High-Hiding All Purpose Primer, N° 046.
  - d. Pittsburgh: "Seal Grip Interior/Exterior Universal Primer/Sealer", 17-921 series.
  - e. Sherwin-Williams: "PrepRite ProBlock Primer/Sealer", B51 W620 Series.
2. Two coats acrylic semi-gloss enamel:
- a. California: "Fres-Coat Unite Semi-Gloss", N°. 563.
  - b. Glidden Professional: Ultra Hide 250 Semi-Gloss N°. 1406.
  - c. Moore: "Ultra Spec 500 Latex Semi Gloss N539.
  - d. Pittsburgh: "Speedhide Interior Semi-Gloss", 6-500 Series.
  - e. Sherwin-Williams: "ProMar 200 Zero VOC Semi-Gloss", B31-2600 Series.
- T. Interior WOOD TRIM, unfinished, to receive transparent-stain polyurethane (water-based) finish.
1. One coat paste wood filler for open-grained woods.
- a. California: No equivalent.
  - b. Glidden Professional: No equivalent.
  - c. Moore: "Benwood Paste Wood Grain Filler", N°. 238.
  - d. Pittsburgh: No equivalent.
  - e. Sherwin-Williams: "SherWood Paste Filler", D70T1 Series.
2. One coat acrylic stain: As recommended or acceptable to water-based polyurethane finish manufacturer, in tint to achieve finish matching Architect's Sample.
3. Two coats of satin-gloss (low luster) finish clear water-based polyurethane
- a. Cabot: Water-based Polyurethane Varnish - Satin" No. 2201.

- b. California:
- c. Glidden Professional: Woodpride Water-Based Varnish Satin N°. 1802.
- d. Moore: "Benwood Clear Acrylic Polyurethane Finish - Low Lustre", N°. 423.
- e. Pittsburgh: Olympic Interior Water Based Polyurethane", N°. 42386.
- f. Sherwin-Williams: "Wood Classics Waterborne Polyurethane Varnish – Satin", A68 Series.

#### 1.4 PAINTING SCHEDULE FOR FIRE RESISTIVE AND RATED DESIGNATIONS

- A. In compliance with the *International Building Code*, 2018 edition, as published by the International Code Council, Inc. (I.C.C.), as amended and incorporated under Title 19 NYCCR part 1221 - *Building Code of New York State*, 2020 edition, and as additionally specified herein, provide identification for all fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions and any other wall or partition which is required to have protected openings or penetrations.
  - 1. Application:
    - a. Apply to outside of fire rated shafts, and to both sides of partitions at intervals not to exceed 10'-0" for entire length of partition or wall, or once on any partition 10'-0 feet or less in length.
    - b. Locate identification in all accessible concealed floor, floor-ceiling and attic spaces. Locate identification within 12 to 18 inches above finished ceilings.
    - c. Apply stenciled lettering by spray or brush, or provide permanent signage. Identification shall be waterproof, fade-proof and non-combustible. Signage shall be mechanically fastened or permanently adhered to partition.
    - d. Stencil character height: 3 inch (76mm) minimum, sans-serif block lettering font, having minimum 3/8 inch width (9.5mm) strokes, with wording in all capital lettering.
    - e. Color: Easily identifiable color, contrasting with background, acceptable to authorities having jurisdiction.
  - 2. Apply stenciled lettering to the following types of partitions using wording specified:
    - a. Applied identification for 2 hour fire rated partitions shall read: "2 HOUR FIRE WALL - PROTECT ALL OPENINGS".
    - b. Applied identification for 1 hour fire rated partitions shall read: "1 HOUR FIRE WALL - PROTECT ALL OPENINGS".
    - c. Applied identification for Smoke barriers shall read: "1 HOUR SMOKE BARRIER - PROTECT ALL OPENINGS".
    - d. Applied identification for Smoke partitions shall read: "SMOKE BARRIER PARTITION - PROTECT ALL OPENINGS".

#### 1.5 PAINTING SCHEDULE FOR MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black enamel.

- B. Paint dampers exposed behind louvers, grilles, and convectors and baseboard cabinets to match face panels.
- C. Remove unfinished louvers, grilles, covers and access panels on and paint as scheduled above.
- D. Fire-Resistant treated plywood backboards for electrical panels and other equipment. Paint both front and back surfaces and all edges of plywood backboards before backboards are installed.
  - 1. One coat latex primer-sealer (undercoater):
    - a. Glidden Professional: Lifemaster No VOC Primer N°. 9116.
    - b. Moore: "Ultra Spec 500 Latex Primer N534.
    - c. Pittsburgh: "Pure Performance Interior Latex Primer".
    - d. Sherwin-Williams: "Harmony Interior Latex Primer" B11W900.
  - 2. Two coats latex semi-gloss paint:
    - a. Glidden Professional: Lifemaster No VOC Semi-Gloss" N°. 9200.
    - b. Moore: "Ultra Spec 500 Semi Gloss N539.
    - c. Pittsburgh: "Pure Performance Interior Semi-gloss", 9-500 Series.
    - d. Sherwin-Williams: "Harmony Interior Latex Semi-gloss" B10 Series.
- E. Non-rated (untreated) plywood backboards for electrical panels and other equipment. Paint with fire-resistant rated paint both front and back surfaces and all edges of plywood backboards before backboards are installed.
  - 1. One coat latex primer-sealer (undercoater):
    - a. Glidden Professional: Lifemaster No VOC Primer N°. 9116.
    - b. Moore: "EcoSpec Interior Latex Primer Sealer" 231.
    - c. Pittsburgh: "Pure Performance Interior Latex Primer".
    - d. Sherwin-Williams: "Harmony Interior Latex Primer" B11W900.
  - 2. Two coats fire retardant paint:
    - a. Firefree Coatings, Inc., San Rafael CA., product "Firefree22".
    - b. Flamstop, Inc., Fort Worth TX., product "Flamestop III paint additive" (mixed with latex paint, refer to wood trim paints specified herein).
    - c. Rosco Inc., Sun River CA. Product "Flamex paint additive" (mixed with latex paint, refer to wood trim paints specified herein).
    - d. Fire Retardants Inc., Chaska MN., Product "Burn Barrier 20-20".
    - e. Flame Control Coatings Inc., Niagara Falls, NY, product: "Flame Control 20-20)
- F. Prime and paint insulated and exposed cold pipes, conduit, electrical boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are located in storage, mechanical or equipment spaces or those items which are factory prefinished.
- G. Exposed to view un-insulated hot pipes within finished painted areas: Two coats heat-resistant enamel conforming to Federal Specification TT-E-496, Type I, applied when surfaces are less than 140 degrees Fahrenheit.

End of Document

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Section 10 11 16  
MARKERBOARDS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Resinous Dry-marker boards
  - 2. Trim, chalkrail and accessories

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood and plywood blocking.
- C. Section 06 20 00 - FINISH CARPENTRY: Wood frame for marker boards, and wood marker rail.
- D. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Reinforcing plate blocking.
- E. Section 09 29 00 - GYPSUM BOARD: Gypsum board substrate.
- F. Section 11 52 13 - PROJECTION SCREENS: Manual projection screens mounted to chalkboard marker board frame.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01420 - REFERENCES.
  - 1. ASTM A 424 - Steel Sheets for Porcelain Enameling.
  - 2. ASTM B 209 - Aluminum-Alloy Sheet and Plate.
  - 3. PEI - Performance Specifications for Porcelain Enamel Chalkboards.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01330 - SUBMITTAL PROCEDURES:
  - 1. Literature: Manufacturer's product data sheets for each item furnished hereunder.

2. Selection samples: Manufacturer's sample chain showing finishes and colors available, for both dry-marker boards and chalkboards, for selection by Architect.
3. Provide maintenance information on regular cleaning and stain removal for markerboards and chalkboards.
4. Provide maintenance information on regular cleaning and stain removal for markerboards and chalkboards.
5. LEED Submittal Requirements:
  - a. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):
    - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
      - a) The exposure scenario used to determine compliance.
      - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
      - c) Laboratory accreditation under ISO/IEC 17025.
      - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
    - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
    - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.

#### 1.6 QUALITY ASSURANCE

- A. Contractor is fully responsible for proper handling during demolition and salvage, temporary storage and re-installation of slate chalkboards. Broken or otherwise damaged slate chalkboards shall be replaced in like units to match existing.

#### 1.7 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Provide manufacturer's standard 5 year warranty which shall include coverage of dry-marker board and porcelain enamel chalkboard surfaces from discoloration due to cleaning.

#### 1.8 MAINTENANCE

- A. Provide maintenance information on regular cleaning, stain removal for both dry-marker boards and chalkboards.

## PART 2 – PRODUCTS

### 2.1 MANUFACTURER

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Deko LCC, Saint Paul, MN., product Deko Magnetic Markerboards. (*contact phone number 844-366-1545*).

### 2.2 RESINOUS DRY MARKER BOARDS

- A. Frameless units of size(s), and orientation as indicated on Drawings.
- B. Description:
  - 1. Resinous Markerboard: Glass free, magnetic, non-staining, resinous panel, frameless with polished and beveled edges, shatterproof and optically clear.
  - 2. Non-staining shall mean impervious to staining from dry erase, wet erase, and permanent markers.
  - 3. Markerboard colorant: Permanent opaque color on back. Color selected by Architect from manufacturer's full available line of colors.
  - 4. Edges: Manufacturer's (frameless) Brilliance profile unless otherwise indicated.
    - a. Corners: "Crown" (manufacturer's standard).
- C. Markerboard Setting:
  - 1. Permanent. Provide manufacturer's recommended adhesive setting [OR]
- D. Marker Tray(s)
  - 1. Manufacturer's standard magnetic tray
- E. Accessories: Furnish each board with manufacturer's "Magnetic Accessory Kit" which includes
  - 1. Magnetic cup
  - 2. Magnetic eraser
  - 3. Dry erase markers
  - 4. Magnets

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that surfaces and internal wall blocking are ready to receive work of this Section.
- B. Beginning of installation means acceptance of existing substrate.

### 3.2 INSTALLATION - MARKERBOARDS

- A. General: Install markerboards in accordance with manufacturer's instructions. Protect porcelain enamel facing from chipping and damage during handling and installation. Install units level and plumb utilizing manufacturer's recommended adhesive.



1. Protect board edges from chipping and damage during handling and installation.

3.3 CLEANING

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover boards with protective cover taped to frame. Remove cover on Date of Substantial Completion.

End of Section

Section 10 14 00  
SIGNAGE

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SECTION INCLUDES

- A. The work of this Section consists of the following sign categories:
  - 1. Interior
    - a. Room and area identification
    - b. Informational
    - c. Directional
    - d. Regulatory
  - 2. Exterior
    - a. Identification
    - b. Regulatory
- B. The items below are included as part of this specification.
  - 1. General sign type drawings, including overall sign shape, size and graphic layout
  - 2. Mounting drawings, showing mounting heights and relationships to site and/or building elements
  - 3. Detailed sign type drawings, indicating type styles, symbols, dimensioned graphic layouts, methods of graphic application, colors, and primary materials
  - 4. Construction drawings, showing fabrication and mounting details
  - 5. Preliminary sign schedule, listing sign location number, sign type, sign message, quantity and notes of clarification, if any
  - 6. Sign location plans, indicating the location of each sign with its number

1.3 RELATED SECTIONS

- A. Section 018113 SUSTAINABLE DESIGN REQUIREMENTS

1.4 ACTION SUBMITTALS

- A. The sign contractor shall submit the following to the general contractor prior to fabrication, under the provisions of Section 013300 SUBMITTAL PROCEDURES
  - 1. Construction shop drawings for all sign types showing shape, size, type styles, symbols, dimensioned graphic layouts, methods of graphic application, colors, materials, and fabrication and mounting details

2. Sign mounting drawings showing mounting heights and relationship to site and/or building elements
  3. Final sign message schedule
    - a. The sign contractor will meet with the architect, owner and general contractor, as directed and as necessary, to confirm all text and graphic content for each sign element; particular attention is directed to the room numbering system for the sign program which is to be included in the overall sign message schedule review; the sign contractor will amend the preliminary sign message schedule included in these construction documents, as necessary
    - b. The resulting sign message schedule will be submitted by the sign contractor for approval, and will list each individual sign, together with a unique sign location number, sign type designation, sign message and graphic content, quantity, and notes of clarification, if any
  4. Sign location plans indicating the location of each sign with its number
  5. The sign contractor will be responsible for production of all graphic artwork for all sign types. If evacuation maps are required, the architect will provide typical floor plan artwork to the sign contractor to use as "style guides" for their production of final artwork. The sign contractor will meet with the architect and the owner, as necessary, to confirm the content of all floor plans including location of fire safety equipment and preferred evacuation routes.
  6. Two full size printed layouts of artwork proofs for each sign type and each unique layout
  7. Two samples of the following Sign Types: 10, 15, 16B
  8. Two color chip samples of each color and finish of exposed materials, minimum 4" x 4", applied to actual sign material substrates
- B. All signage samples are to be delivered for review and approval in a single submission package.
- 1.5 SIGN CONTRACTOR QUALIFICATION
- A. The sign contractor shall submit the names of five projects, completed in the last three years, which are similar in scope to this project. The sign contractor shall provide information for each project including contact name, telephone number, and email address.
- 1.6 REGULATORY REQUIREMENTS
- A. Provide all signs in accordance with, and as required by Federal, state, or local building code or ordinances including ADAAG – Americans with Disabilities Act Accessibility Guidelines, 2010 Standards, as issued by the US Department of Justice. Code compliant signage shall include, but not be limited to, building egress, elevator operation, fire safety regulations, and health and safety requirements.
- 1.7 COORDINATION
- A. The sign contractor will notify the general contractor of any special anchoring provisions, such as blocking, to be made in walls and ceilings prior to sign installation. The notifications will be timely, before walls and ceilings are closed.

1.8 PERMITS

- A. The sign contractor will obtain any permits required for signs, if these permits are separate from the basic building permit obtained by the construction manager.

**PART 2 - PRODUCTS**

2.1 SIGNAGE GENERAL

- A. The room numbers and text shown on the sign schedule are preliminary and are subject to revision.

2.2 INTERIOR SIGNS

- A. Flush Wall Mount Plaque, Tactile. Product will be fabricated and installed by sign contractor. All tactile wall mounted plaques will incorporate thermoformed acrylic plaque faces as manufactured by Asante Sign Group of Gloversville NY, [www.asantesigngroup.com](http://www.asantesigngroup.com), or approved equal. Product will include raised graphics and braille, and digitally printed graphics, as shown on the construction drawings. Tactile flush wall mount plaques shall be fabricated with slots for removable inserts, and mounting adhesives to allow for attachment to designated building surfaces, as shown on the construction drawings. When product is mounted on glass surfaces, as indicated in the message schedule, a pressure-sensitive vinyl backer in the same dimension as the sign assembly will be mounted to the first surface of the glass. All components to be cut on CNC equipment and all dimensional and alignment tolerances shall not exceed +/- .005". Product will be used for Sign Types 10, 11, 12, 13, 14, 14A, 17, 17A, and 18.
- B. Flush Wall Mount Plaque, Non-Tactile. Product will be fabricated and installed by sign contractor. Non-tactile wall mounted plaques will incorporate acrylic plaque faces, slots for removable inserts, digitally printed graphics, and mounting adhesives to allow for attachment to designated building surfaces, as shown on the construction drawings. When product is mounted on glass surfaces, as indicated in the message schedule, a pressure-sensitive vinyl backer in the same dimension as the sign assembly will be mounted to the first surface of the glass. All components to be cut on CNC equipment and all dimensional and alignment tolerances shall not exceed +/- .005". Product will be used for Sign Types 15, 16A, 16B, 16C, 16D, 19, 21, 24, and 25.
- C. Flush Wall Mount Plaque, Non-Tactile, Aluminum. Product will be fabricated and installed by sign contractor. Non-tactile wall mounted plaques will incorporate aluminum faces, digitally printed graphics, and mounting adhesives, to allow for attachment to designated building surfaces, as shown on the construction drawings. When product is mounted on glass surfaces, as indicated in the message schedule, a pressure-sensitive vinyl backer in the same dimension as the sign assembly will be mounted to the first surface of the glass. All components to be cut on CNC equipment and all dimensional and alignment tolerances shall not exceed +/- .005". Product will be used for Sign Types 23 and 31.
- D. Vinyl Graphics. Vinyl graphics will be fabricated and installed by sign contractor. Surface applied vinyl graphics will be applied to designated building surfaces. Product will be used for Sign Type 25 (alternate).

## 2.3 EXTERIOR SIGNS

- A. Flush Wall Mount Plaque, Tactile. Product will be fabricated and installed by sign contractor. All tactile wall mounted plaques will incorporate thermoformed acrylic plaque faces as manufactured by Asante Sign Group of Gloversville NY, [www.asantesigngroup.com](http://www.asantesigngroup.com), or approved equal. Product will include raised graphics and braille, digitally printed graphics, and mounting adhesives to allow for attachment to designated building surfaces, as shown on the construction drawings. All components to be cut on CNC equipment and all dimensional and alignment tolerances shall not exceed +/- .005". Product will be used for Sign Types 50, 51 and 52.
- B. Flush Wall Mount Plaque, Non-Tactile, Aluminum. Product will be fabricated and installed by sign contractor. Non-tactile wall mounted plaques will incorporate aluminum faces, digitally printed graphics, and mounting adhesives, to allow for attachment to designated building surfaces, as shown on the construction drawings. When product is mounted on glass surfaces, as indicated in the message schedule, a pressure-sensitive vinyl backer in the same dimension as the sign assembly will be mounted to the first surface of the glass. All components to be cut on CNC equipment and all dimensional and alignment tolerances shall not exceed +/- .005". Product will be used for Sign Types 53 and 60
- C. Freestanding monolithic blade, steel. Product will be fabricated and installed by sign contractor. Product will incorporate a welded steel structure, vinyl graphics, and concrete foundation, as shown on the construction drawings. Product will be used for Sign Type 54.

## 2.4 BASIS FOR DESIGN

- A. The products, fabricators, manufacturers, and materials shown for each sign type is intended to be the basis for design. Equal sign products from other manufacturers may be submitted to the architect for approval prior to bidding. All work will be as shown on the construction drawings.

## 2.5 MATERIALS

- A. Acrylic shall clear Acrylite cast acrylic sheet, smooth both faces, as manufactured by Evonik Industries, Parsippany, NJ, [www.acrylite.net](http://www.acrylite.net).
- B. Polycarbonate shall be clear, matte finish one face, as manufactured by Sheffield Plastics, Sheffield, MA., [www.sheffieldplastics.com](http://www.sheffieldplastics.com).
- C. Paint shall be acrylic polyurethane MAP, as manufactured by Matthews Paint, Delaware, OH, [www.matthewspaint.com](http://www.matthewspaint.com).
- D. Foam tape shall be 4416, as manufactured by 3M Company, St. Paul, MN, [www.3M.com](http://www.3M.com).
- E. VHB foam tape shall be 4950, as manufactured by 3M Company, St. Paul, MN, [www.3M.com](http://www.3M.com).
- F. Silicone adhesive shall be 732 Multipurpose RTV Sealant, as manufactured by Dow Corning, Midland, MI, [www.dowcorning.com](http://www.dowcorning.com).
- G. Pressure sensitive vinyl graphic film shall be Scotchcal 77125 Electrocut Graphic Film, as manufactured by 3M Company, St. Paul, MN, [www.3M.com](http://www.3M.com).

- H. Expanded PVC shall be manufactured by Komatex, Huntsville, AL, [www.kommerlingusa.com](http://www.kommerlingusa.com).
- I. All other secondary materials shall be as shown on the construction drawings.

## 2.6 FABRICATION

- A. All graphic elements, including text and symbols, will be reproduced from computer generated digital artwork. All vector artwork created for graphic reproduction will be output at a minimum resolution of 1200 dpi. All computer generated non-vector artwork will be saved at 300 dpi, at full size, and will be output at a minimum resolution of 1200 dpi.
- B. All graphic elements, including text and symbols, will be reproduced with sharp inside and outside corners and edges. No rounded corners or edges shall be permitted.
- C. All graphic elements will be produced in such a manner that all edges and corners of letterforms, symbols, color bands, rules, and borders, are true and clean. All printed inks shall be applied evenly without pinholes, scratches, or orange-peel texture.
- D. All painted components will be spray finished in such a manner that exposed surfaces are free of dust under the paint surface, orange-peel texture, runs, color streaks, or build-up at edges. Sharp edges and corners will be broken prior to painting. All surfaces shall be prepared, primed, and finished in accordance with the published application instructions of the paint manufacturer.
- E. Colors and metal finishes will be selected by the architect from the standard offering of each manufacturer. Custom colors, if desired, will be shown on sign construction drawings.
- F. Type styles and symbols will be as shown on the general and detailed sign type drawings.
- G. All Braille on tactile signs shall be accurate Grade 2 translations, and shall conform to the provisions of ADAAG and ICC/ANSI A117.1 with regard to size, position, spacing, and profile (domed top) characteristics.
- H. Thermoformed acrylic plaques with raised graphics and Braille shall be produced utilizing a high-pressure thermoforming process at 4,000 psi, and 350 degree F, and shall form a monolithic component.
- I. All fabrication workmanship shall be of best quality in every particular, complete in every detail, and strictly in accordance with best practices. All exposed and fabricated joints shall be tight and completely smooth. All sign faces shall be free of cupping, oil-canning, or other deflections.

## 2.7 PACKAGING

- A. Every effort should be made to use biodegradable and recyclable packaging materials.
- B. Pack each sign so as to prevent scratches and surface damage.
- C. See 3.7 for disposal of waste.

2.8 WARRANTY

- A. All products will be guaranteed against defects in materials and workmanship for a period of three years from the date of installation. Warranty is void if product is not maintained according to the manufacturer's recommendations.

**PART 3 - EXECUTION**

3.1 DELIVERY, STORAGE, HANDLING

- A. If stored at the site, all materials will be in an elevated, dry location, protected by a waterproof covering. The location will be coordinated with the general contractor.

3.2 ENVIRONMENTAL CONDITIONS

- A. Store all adhesives at room temperatures of no less than 55 degrees.

3.3 SITE INSPECTION

- A. Examine mounting surfaces, areas, and conditions with the general contractor present. Check for compliance with requirements for installation, and other factors affecting the performance of the work.

3.4 INSTALLATION

- A. Install all signs, according to the manufacturer's recommendations, and as shown on the construction drawings.
- B. Install all signs plumb and level at specific locations shown on the sign location plans and construction drawings.
- C. Exposed fasteners will not be permitted, unless specifically shown and required on the construction drawings, or approved by the architect.
- D. All signs will be shop-fabricated, and where practical, delivered to the site completely assembled. All signs that cannot be delivered fully assembled shall be erected and assembled so that all parts fit accurately with hairline joints.

3.5 PROJECT SCHEDULE

- A. All work will be performed in accordance with a schedule approved by the construction manager. The sign contractor shall assume that all signs will be installed in two separate phases occurring within a period of 36 months.
- B. All sign installation work will be completed prior to occupancy permit inspections. Temporary signs are not included

3.6 CLEANING

- A. Clean all signs following installation with a mild, non-streaking, wall cleaning solution for normal dirt and finger prints. Care should be taken not to scratch the sign surface.

3.7 WASTE MANAGEMENT

- A. The sign contractor shall handle and manage all waste materials in accordance with the provisions of Section 018110 SUSTAINABLE DESIGN REQUIREMENTS.

3.8 RE-ORDER PROCESS

- A. Upon completion of the installation, the sign contractor will submit as-built drawings, and maintenance instructions to the facility representative.
- B. The sign contractor will supply to the facility representative re-order instructions for replacement of sign parts such as name strips, and for the ordering of new signs.

End of Section



## Summary

Sign Type	Sign Type Name	Quantity
10	Residential Unit ID	288
11	Primary Room ID	55
12	Utility Room ID	88
13	Office ID	1
14	Restroom ID	55
14A	Room ID w/ Icon	1
15	Paper Insert Plaques - Unit Egress	288
16A	Directional/Wayfinding (short)	47
16B	Directional/Wayfinding (med)	24
16C	Directional/Wayfinding (long)	6
16D	Directional/Wayfinding (supplemental)	17
17	Stair ID (egress)	41
17A	Stair ID (convenience)	15
18	Stair Level ID	50
19	Stair Landing	32
20	Exit ID	23
21	Occupancy	19
23	Interior FD Regulatory	1
24	2-way Communication Device	17
25	Entry Signage	11
30	Elevator Egress Maps	19
31	Elevator Regulatory	5
50	Exterior Door ID	8
51	Ext Building ID	5
52	Ext Building ID / Accessibility	4
53	Ext Accessibility Directional	4
54	Ext Accessibility Directional, Freestanding	1
60	Exterior FD Regulatory	3
99	Tatkon Room ID	2

## Sign Schedule

Number	Type	Message	Notes	Unit Color	Glass Backer
01-001	10	1122 (braille)		0-Neutral	
01-001A	15			0-Neutral	
01-003	25	[symbol] NO SMOKING 25 FEET FROM THIS AREA [symbol] NO BIKES [symbol] NO PETS [symbol] SURVEILLANCE THIS AREA IS SUBJECT TO SURVEILLANCE FOR SECURITY PURPOSES AND MAY OR MAY NOT BE MONITORED	Confirm with architect/owner whether plaque or glass-mounted vinyl version is to be used, as well as final field location.	0-Neutral	
01-004	11	1136 MUSIC ROOM (Braille)		0-Neutral	
01-005	12	1124 STORAGE (Braille)		0-Neutral	
01-006	11	1140 MULTIPURPOSE (Braille)		0-Neutral	
01-008	12	1140A STORAGE (Braille)		0-Neutral	
01-009	12	1142 BEF (Braille)		0-Neutral	
01-010	14	(women/accessible symbol) 1114 RESTROOM (braille)		0-Neutral	
01-011	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 1 (Braille)		0-Neutral	
01-012	18	FLOOR 1 (Braille)		0-Neutral	
01-013	19	STAIR 1 NO ROOF ACCESS 1 FLOORS 1-5 EXIT AT GROUND (up arrow)		0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
01-014	18	FLOOR 1 (Braille)		0-Neutral	
01-015	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 1 (Braille)		0-Neutral	
01-016	11	1112 LAUNDRY (Braille)		0-Neutral	Yes
01-017	12	10061 ELECTRICAL No Storage Allowed (Braille)		0-Neutral	
01-018	12	10062 MAIN ELECTRICAL No Storage Allowed (Braille)		0-Neutral	
01-019	12	10060 EMERGENCY ELECTRICAL No Storage Allowed (Braille)		0-Neutral	
01-020	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 1		0-Neutral	
01-021	12	10063 MECHANICAL (Braille)		0-Neutral	
01-022	12	10063 MECHANICAL (Braille)		0-Neutral	
01-023	12	10064 MDF (Braille)		0-Neutral	
01-024	12	10065 STORAGE (Braille)		0-Neutral	
01-025	11	1150 BICYCLE STORAGE (Braille)		0-Neutral	
01-026	12	10066 SPRINKLER CONTROL (Braille)		0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
01-027	12	10080 JANITOR (Braille)		0-Neutral	
01-028	12	10068 PLUMBING SERVICE (Braille)		0-Neutral	
01-029	12	10067 EMERGENCY ELECTRICAL No Storage Allowed (Braille)		0-Neutral	
01-030	12	UTILITY CORRIDOR (Braille)		0-Neutral	
01-033	52	BALCH HALL (Braille) (blue accessible symbol)		0-Neutral	
01-035	23	SPRINKLER VALVE		0-Neutral	
01-038	20	EXIT (Braille)	**NOT ACCESSIBLE?	0-Neutral	
01-039	12	10081 UTILITY (Braille)		0-Neutral	
01-040	12	10062 MAIN ELECTRICAL No Storage Allowed (Braille)		0-Neutral	
01-041	12	10067 EMERGENCY ELECTRICAL No Storage Allowed (Braille)		0-Neutral	
01-042	52	STAIR 1 (Braille) (left arrow)(accessible symbol)		0-Neutral	
01-043	52	BALCH HALL (Braille) (blue accessible symbol)		0-Neutral	
01-044	50	1150 BICYCLE STORAGE (Braille)		0-Neutral	
01-046	16B	(left arrow) Bicycle Storage (right arrow) Suite 1122 Music Room Multipurpose Room		0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
01-047	16B	(up arrow) Laundry Vending Elevator Bicycle Storage		0-Neutral	
01-048	16A	(up arrow) Suite 1122 Music Room Multipurpose Room		0-Neutral	
01-049	20	EXIT (Braille)		0-Neutral	
01-050	20	EXIT (Braille)		0-Neutral	
01-051	60	FDC	confirm location	0-Neutral	
02-001	51	NORTH BALCH HALL (Braille)		0-Neutral	
02-003	25	[symbol] NO SMOKING 25 FEET FROM THIS AREA [symbol] NO BIKES [symbol] NO PETS [symbol] SURVEILLANCE THIS AREA IS SUBJECT TO SURVEILLANCE FOR SECURITY PURPOSES AND MAY OR MAY NOT BE MONITORED	Confirm with architect/owner whether plaque or glass-mounted vinyl version is to be used, as well as final field location.	0-Neutral	
02-004	14	(men/accessible symbol) 2102 MEN (Braille)		1-Red	
02-005	14	(women/accessible symbol) 2104 WOMEN (Braille)		1-Red	
02-006	53	(accessible symbol)(right arrow)		0-Neutral	
02-007	20	EXIT (Braille)		1-Red	
02-008	13	2106 RESIDENCE HALL DIRECTOR (Braille)		1-Red	
02-009	11	2122 UNIT 1 LOUNGE (Braille)		1-Red	
02-010	21	Maximum Occupancy 31	Occupancy load to be confirmed	1-Red	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
02-014	11	2122 LOUNGE (Braille)		1-Red	
02-015	21	Maximum Occupancy 107	Occupancy load to be confirmed	1-Red	
02-016	16A	(up arrow) 2130A-2130F		1-Red	
02-017	11	2122 LOUNGE (Braille)		1-Red	
02-018	10	2130A (Braille)		1-Red	
02-018A	15			0-Neutral	
02-019	10	2130B (Braille)		1-Red	
02-019A	15			0-Neutral	
02-020	10	2130D (Braille)		1-Red	
02-020A	15			0-Neutral	
02-021	10	2130E (Braille)		1-Red	
02-021A	15			0-Neutral	
02-022	14	(women symbol) 2130F BATH (Braille)		1-Red	
02-023	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] STAIR 1 (Braille)		1-Red	
02-024	18	FLOOR 2 (Braille)		1-Red	
02-025	19	STAIR 1 NO ROOF ACCESS 2 FLOORS 1-5 EXIT AT GROUND (down arrow)		1-Red	
02-028	31	ELEVATOR MACHINE ROOM		1-Red	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
02-029	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 2		1-Red	
02-030	16B	(up arrow) 2102-2109 (left arrow) 2141-2181		1-Red	
02-031	11	2141 COUNTRY KITCHEN (Braille)		1-Red	
02-032	14	(women symbol) 2142 BATH (Braille)		1-Red	
02-033	10	2144 (Braille)		1-Red	
02-033A	15			0-Neutral	
02-034	10	2145 (Braille)		1-Red	
02-034A	15			0-Neutral	
02-035	10	2146 (Braille)		1-Red	
02-035A	15			0-Neutral	
02-036	10	2148 (Braille)		1-Red	
02-036A	15			0-Neutral	
02-037	10	2149 (Braille)		1-Red	
02-037A	15			0-Neutral	
02-038	11	2151 LOUNGE (Braille)		1-Red	
02-039	10	2150 (Braille)		1-Red	
02-039A	15			0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
02-040	14	(women/accessible symbol) 2152 BATH (Braille)		1-Red	
02-041	21	Maximum Occupancy 17	Occupancy load to be confirmed	1-Red	
02-042	17A	STAIR 2 (Braille)		1-Red	
02-043	18	FLOOR 2 (Braille)		1-Red	
02-044	16A	(up arrow) 2102-2152 Unit 1 Lounge		1-Red	
02-045	12	20163 IT SEC (Braille)		2-Plum	
02-046	10	2160A (Braille)		2-Plum	
02-046A	15			0-Neutral	
02-047	10	2160B (Braille)		2-Plum	
02-047A	15			0-Neutral	
02-048	10	2160C (Braille)		2-Plum	
02-048A	15			0-Neutral	
02-049	10	2160D (Braille)		2-Plum	
02-049A	15			0-Neutral	
02-050	10	2160E (Braille)		2-Plum	
02-050A	15			0-Neutral	
02-051	10	2160F (Braille)		2-Plum	
02-051A	15			0-Neutral	
02-052	14	(women symbol) 2160G BATH (Braille)		2-Plum	
02-054	16A	(up arrow) 2160A-2160G		2-Plum	



<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
02-057	16A	(up arrow) 2169-2181		2-Plum	
02-058	18	FLOOR 2 (Braille)		2-Plum	
02-059	20	EXIT (Braille)		0-Neutral	
02-060	51	NORTH BALCH HALL (Braille)		0-Neutral	
02-061	17A	STAIR 2 (Braille)		2-Plum	
02-062	14	(women/accessible) symbol) 2169 BATH (Braille)		2-Plum	
02-063	12	20080 JANITOR (Braille)		2-Plum	
02-064	10	2170 (Braille)		2-Plum	
02-064A	15			0-Neutral	
02-065	10	2171 (Braille)		2-Plum	
02-065A	15			0-Neutral	
02-066	10	2172 (Braille)		2-Plum	
02-066A	15			0-Neutral	
02-067	10	2173 (Braille)		2-Plum	
02-067A	15			0-Neutral	
02-068	10	2174 (Braille)		2-Plum	
02-068A	15			0-Neutral	
02-069	10	2175 (Braille)		2-Plum	
02-069A	15			0-Neutral	
02-070	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 3 (Braille)		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
02-071	18	FLOOR 2 (Braille)		2-Plum	
02-072	16A	(up arrow) 2102-2175		2-Plum	
02-073	19	STAIR 3 NO ROOF ACCESS 2 FLOORS 2-6 EXIT THIS FLOOR		2-Plum	
02-074	18	FLOOR 2 (Braille)		2-Plum	
02-075	16A	(up arrow) 2181		2-Plum	
02-076	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 3 (Braille)		2-Plum	
02-077	12	20049 UTILITY (Braille)		2-Plum	
02-078	12	20069 UTILITY (Braille)		2-Plum	
02-079	10	2181 (Braille)		2-Plum	
02-079A	15			0-Neutral	
02-080	20	EXIT (Braille)		2-Plum	
02-081	25	[symbol] NO SMOKING 25 FEET FROM THIS AREA [symbol] NO BIKES [symbol] NO PETS [symbol] SURVEILLANCE THIS AREA IS SUBJECT TO SURVEILLANCE FOR SECURITY PURPOSES AND MAY OR MAY NOT BE MONITORED	Confirm with architect/owner whether plaque or glass-mounted vinyl version is to be used, as well as final field location.	0-Neutral	
02-082	54	(left arrow)(accessible symbol)		0-Neutral	
02-084	51	SOUTH BALCH HALL (Braille)		0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
02-085	25	[symbol] NO SMOKING 25 FEET FROM THIS AREA [symbol] NO BIKES [symbol] NO PETS [symbol] SURVEILLANCE THIS AREA IS SUBJECT TO SURVEILLANCE FOR SECURITY PURPOSES AND MAY OR MAY NOT BE MONITORED	Confirm with architect/owner whether plaque or glass-mounted vinyl version is to be used, as well as final field location.	0-Neutral	
02-086	21	Maximum Occupancy 23	Occupancy load to be confirmed	3-Gold	
02-088	11	2203 BREAKOUT ROOM (Braille)		3-Gold	
02-090	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 2		3-Gold	
02-091	11	2210 LOUNGE (Braille)		3-Gold	
02-092	14	(women/accessible symbol) 2207 RESTROOM (Braille)		3-Gold	
02-093	14	(women/accessible symbol) 2208 RESTROOM (Braille)	CONFIRM ROOM NUMBER	3-Gold	
02-094	19	STAIR 5 NO ROOF ACCESS 2 FLOORS 2-5 EXIT THIS FLOOR		3-Gold	
02-095	17A	STAIR 2 (Braille)		3-Gold	
02-096	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] STAIR 5 (Braille)		3-Gold	
02-097	11	2219 COUNTRY KITCHEN (Braille)		3-Gold	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
02-098	12	20067 ELECTRICAL No Storage Allowed (Braille)		3-Gold	
02-099	12	20066 EMERGENCY ELECTRICAL No Storage Allowed (Braille)		3-Gold	
02-100	12	20081 JANITOR (Braille)		3-Gold	
02-101	16A	(up arrow) 2230-2280		3-Gold	
02-102	16A	(up arrow) 2203-2219 Elevator		3-Gold	
02-103	10	2330 (Braille)		3-Gold	
02-103A	15			0-Neutral	
02-104	11	#### LAUNDRY (Braille)		3-Gold	
02-105	25	[symbol] NO SMOKING 25 FEET FROM THIS AREA [symbol] NO BIKES [symbol] NO PETS [symbol] SURVEILLANCE THIS AREA IS SUBJECT TO SURVEILLANCE FOR SECURITY PURPOSES AND MAY OR MAY NOT BE MONITORED	Confirm with architect/owner whether plaque or glass-mounted vinyl version is to be used, as well as final field location.	0-Neutral	
02-106	51	SOUTH BALCH HALL (Braille)		0-Neutral	
02-107	10	2234 (Braille)		3-Gold	
02-107A	15			0-Neutral	
02-108	10	2236 (Braille)		3-Gold	
02-108A	15			0-Neutral	
02-109	14	(women/accessible symbol) 2237 BATH (Braille)		3-Gold	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
02-110	11	2245 LOUNGE (Braille)		3-Gold	
02-111	10	2246 (Braille)		3-Gold	
02-111A	15			0-Neutral	
02-112	10	2248 (Braille)		3-Gold	
02-112A	15			0-Neutral	
02-113	10	2250 (Braille)		3-Gold	
02-113A	15			0-Neutral	
02-114	12	2251 TATKON MECHANICAL (Braille)		0-Neutral	
02-115	12	20063 SEC (Braille)		0-Neutral	
02-117	18	FLOOR 2 (Braille)		0-Neutral	
02-118	17A	STAIR 6 (Braille)		0-Neutral	
02-119	16B	(right arrow) 2203-2251 Elevator (left arrow) 2267-2280		0-Neutral	
02-120	12	20264 TRASH / RECYCLING (Braille)		0-Neutral	
02-121	50	20264 TRASH / RECYCLING (Braille)		0-Neutral	
02-122	50	20262 LOADING (Braille)		0-Neutral	
02-123	12	20265 MECHANICAL (Braille)		0-Neutral	
02-124	11	2267 BICYCLE STORAGE (Braille)		0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
02-125	12	UTILITY CORRIDOR (Braille)		0-Neutral	
02-126	12	2269 TATKON SUPPORT (Braille)		0-Neutral	
02-127	12	20265 MECHANICAL (Braille)		0-Neutral	
02-128	12	2271 IDF (Braille)		0-Neutral	
02-130	12	2273 TATKON SUPPORT (Braille)		0-Neutral	
02-131	12	2274 STORAGE (Braille)		0-Neutral	
02-132	12	2275 STORAGE (Braille)		0-Neutral	
02-133	12	2276 STORAGE (Braille)		0-Neutral	
02-134	12	2277 STORAGE (Braille)		0-Neutral	
02-135	12	20267 RISER (Braille)		0-Neutral	
02-136	12	2278 STORAGE (Braille)		0-Neutral	
02-137	12	2280 STORAGE (Braille)		0-Neutral	
02-138	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 7 (Braille)		0-Neutral	
02-139	18	FLOOR 2 (Braille)		0-Neutral	
02-140	19	STAIR 7 NO ROOF ACCESS 2 FLOORS 2-6 EXIT AT GROUND (up arrow)		0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
02-143	20	EXIT (Braille)		1-Red	
02-144	20	EXIT (Braille)		1-Red	
02-145	20	EXIT (Braille)		3-Gold	
02-146	20	EXIT (Braille)		3-Gold	
02-147	20	EXIT (Braille)		3-Gold	
02-148	20	EXIT (Braille)		3-Gold	
02-149	20	EXIT (Braille)		0-Neutral	
02-150	21	Maximum Occupancy 23		3-Gold	
02-151	21	Maximum Occupancy 58		3-Gold	
02-152	11	2205 LOUNGE (Braille)		3-Gold	
02-153	11	2109 LOUNGE (Braille)		1-Red	
02-154	16A	(up arrow) 2234-2280 Bicycle Storage		3-Gold	
02-155	25	[symbol] NO SMOKING 25 FEET FROM THIS AREA [symbol] NO BIKES [symbol] NO PETS [symbol] SURVEILLANCE THIS AREA IS SUBJECT TO SURVEILLANCE FOR SECURITY PURPOSES AND MAY OR MAY NOT BE MONITORED	Confirm with architect/owner whether plaque or glass-mounted vinyl version is to be used, as well as final field location.	0-Neutral	
02-156	12	20082 CRAWL SPACE (Braille)		0-Neutral	
02-157	53	(accessible symbol)(right arrow)		0-Neutral	
02-158	53	(accessible symbol)(right arrow)		0-Neutral	
02-159	16D	(right arrow)(accessible symbol)Room 2152		1-Red	
02-160	16D	(right arrow)(accessible symbol)Room 2152		1-Red	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
02-161	16D	(right arrow)(accessible symbol)Room 2169		2-Plum	
02-162	60	FDC			
02-163	60	FDC			
03-001	10	3105B (Braille)		1-Red	
03-001A	15			0-Neutral	
03-002	10	3105C (Braille)		1-Red	
03-002A	15			0-Neutral	
03-003	10	3105D (Braille)		1-Red	
03-003A	15			0-Neutral	
03-004	14	(women/accessible symbol) 3105A BATH (Braille)		1-Red	
03-005	10	3105E (Braille)		1-Red	
03-005A	15			0-Neutral	
03-007	10	3108 (Braille)		1-Red	
03-007A	15			0-Neutral	
03-008	16B	(left arrow) 3105-3108 (right arrow) 3112-3130		1-Red	
03-009	10	3112 (Braille)		1-Red	
03-009A	15			0-Neutral	
03-011	14	(women/accessible symbol) 3120A BATH (Braille)		1-Red	
03-012	10	3120B (Braille)		1-Red	
03-012A	15			0-Neutral	
03-013	10	3120C (Braille)		1-Red	



<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-013A	15			0-Neutral	
03-014	10	3120D (Braille)		1-Red	
03-014A	15			0-Neutral	
03-015	10	3120E (Braille)		1-Red	
03-015A	15			0-Neutral	
03-016	14	(women/accessible symbol) 3130A BATH (Braille)		1-Red	
03-017	10	3130B (Braille)		1-Red	
03-017A	15			0-Neutral	
03-018	10	3130C (Braille)		1-Red	
03-018A	15			0-Neutral	
03-019	10	3130E (Braille)		1-Red	
03-019A	15			0-Neutral	
03-020	10	3130F (Braille)		1-Red	
03-020A	15			0-Neutral	
03-021	10	3130G (Braille)		1-Red	
03-021A	15			0-Neutral	
03-022	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 1 (Braille)		1-Red	
03-023	18	FLOOR 3 (Braille)		1-Red	
03-024	19	STAIR 1 NO ROOF ACCESS 3 FLOORS 1-5 EXIT AT GROUND (down arrow)		1-Red	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-025	12	30061 ELECTRICAL No Storage Allowed (Braille)		1-Red	
03-026	12	30060 EMERGENCY ELECTRICAL No Storage Allowed (Braille)		1-Red	
03-027	11	3141 KITCHEN (Braille)		1-Red	
03-028	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 3		1-Red	
03-029	16B	(right arrow) 3105-3141 (left arrow) 3143-3195		1-Red	
03-030	11	3143 LOUNGE (Braille)		1-Red	
03-032	14	(women symbol) 3144 BATH (Braille)		1-Red	
03-033	10	3145 (Braille)		1-Red	
03-033A	15			0-Neutral	
03-034	10	3146 (Braille)		1-Red	
03-034A	15			0-Neutral	
03-035	10	3147 (Braille)		1-Red	
03-035A	15			0-Neutral	
03-036	10	3148 (Braille)		1-Red	
03-036A	15			0-Neutral	
03-037	10	3149 (Braille)		1-Red	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-037.1	10	3150 (Braille)		1-Red	
03-037.1A	15			0-Neutral	
03-037A	15			0-Neutral	
03-038	10	3151 (Braille)		1-Red	
03-038A	15			0-Neutral	
03-039	12	30080 JANITOR (Braille)		1-Red	
03-040	17A	STAIR 2 (Braille)		1-Red	
03-041	18	FLOOR 3 (Braille)		1-Red	
03-042	16A	(up arrow) 3101-3151 Elevator		1-Red	
03-043	12	30163 IT SEC (Braille)		2-Plum	
03-044	10	3160A (Braille)		2-Plum	
03-044A	15			0-Neutral	
03-045	10	3160B (Braille)		2-Plum	
03-045A	15			0-Neutral	
03-046	10	3160C (Braille)		2-Plum	
03-046A	15			0-Neutral	
03-047	10	3160E (Braille)		2-Plum	
03-047A	15			0-Neutral	
03-048	10	3160F (Braille)		2-Plum	
03-048A	15			0-Neutral	
03-049	10	3160G (Braille)		2-Plum	
03-049A	15			0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-050	14	(women/accessible symbol) 3160H BATH (Braille)		2-Plum	
03-053	16A	(up arrow) 3160A-3160H		2-Plum	
03-055	16A	(up arrow) 3165-3195 Unit 2 Lounge		2-Plum	
03-056	18	FLOOR 3 (Braille)		2-Plum	
03-057	17A	STAIR 2 (Braille)		2-Plum	
03-058	10	3165 (Braille)		2-Plum	
03-058A	15			0-Neutral	
03-059	14	(women/accessible symbol) 3168 BATH (Braille)		2-Plum	
03-060	10	3167 (Braille)		2-Plum	
03-060A	15			0-Neutral	
03-061	10	3169 (Braille)		2-Plum	
03-061A	15			0-Neutral	
03-062	10	3170 (Braille)		2-Plum	
03-062A	15			0-Neutral	
03-063	10	3171 (Braille)		2-Plum	
03-063A	15			0-Neutral	
03-064	10	3173 (Braille)		2-Plum	
03-064A	15			0-Neutral	
03-065	10	3172 (Braille)		2-Plum	
03-065A	15			0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-066	10	3174 (Braille)		2-Plum	
03-066A	15			0-Neutral	
03-067	10	3175 (Braille)		2-Plum	
03-067A	15			0-Neutral	
03-068	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 3 (Braille)		2-Plum	
03-069	16A	(up arrow) 3101-3175		2-Plum	
03-070	18	FLOOR 3 (Braille)		2-Plum	
03-071	19	STAIR 3 NO ROOF ACCESS 3 FLOORS 2-6 EXIT FLOOR 2 (down arrow)		2-Plum	
03-072	11	3185 UNIT 2 LOUNGE (Braille)	LEVEL 3	2-Plum	
03-073	11	3176 STUDY (Braille)	LEVEL 3	2-Plum	
03-074	16A	(up arrow) 3176-3195		2-Plum	
03-075	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 3 (Braille)		2-Plum	
03-076	11	3185 UNIT 2 LOUNGE (Braille)		2-Plum	
03-077	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 3 (Braille)		2-Plum	
03-078	11	3176 STUDY (Braille)		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-079	16D	(u-turn arrow) (accessible symbol) Elevator		2-Plum	
03-080	11	3176 STUDY (Braille)		2-Plum	
03-081	20	EXIT (Braille)		2-Plum	
03-082	12	3186 STORAGE (Braille)		2-Plum	
03-083	16B	(up arrow) 3180-3184 (right arrow) 3186-3195		2-Plum	
03-084	11	3176 STUDY (Braille)		2-Plum	
03-085	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 3		2-Plum	
03-086	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 3		2-Plum	
03-087	10	3180 (Braille)		2-Plum	
03-087A	15			0-Neutral	
03-088	14	(women/accessible symbol) 3184 BATH (Braille)		2-Plum	
03-089	10	3182 (Braille)		2-Plum	
03-089A	15			0-Neutral	
03-090	12	30064 (Braille)		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-091	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 4 (Braille)		2-Plum	
03-092	18	FLOOR 3 (Braille)		2-Plum	
03-093	19	STAIR 4 NO ROOF ACCESS 3 FLOORS 3-6 EXIT THIS FLOOR		2-Plum	
03-094	20	EXIT (Braille)		2-Plum	
03-095	50	STAIR 4 (Braille)		0-Neutral	
03-096	52	BALCH HALL (Braille) (left arrow)(accessible symbol)		0-Neutral	
03-097	25	[symbol] NO SMOKING 25 FEET FROM THIS AREA [symbol] NO BIKES [symbol] NO PETS [symbol] SURVEILLANCE THIS AREA IS SUBJECT TO SURVEILLANCE FOR SECURITY PURPOSES AND MAY OR MAY NOT BE MONITORED	Confirm with architect/owner whether plaque or glass-mounted vinyl version is to be used, as well as final field location.	0-Neutral	
03-098	16A	(up arrow) 3195A-3195E		2-Plum	
03-099	11	3192 KITCHEN (Braille)		2-Plum	
03-100	10	3195E (Braille)		2-Plum	
03-100A	15			0-Neutral	
03-101	14	(women symbol) 3195A BATH (Braille)		2-Plum	
03-102	10	3195D (Braille)		2-Plum	
03-102A	15			0-Neutral	
03-103	10	3195B (Braille)		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-103A	15			0-Neutral	
03-104	10	3195C (Braille)		2-Plum	
03-104A	15			0-Neutral	
03-105	12	#### TBD (Braille)		3-Gold	
03-106	10	3205D (Braille)		3-Gold	
03-106A	15			0-Neutral	
03-107	10	3205C (Braille)		3-Gold	
03-107A	15			0-Neutral	
03-108	10	3205B (Braille)		3-Gold	
03-108A	15			0-Neutral	
03-109	14	(women symbol) 3205E RESTROOM (Braille)		3-Gold	
03-110	10	3205A (Braille)		3-Gold	
03-110A	15			0-Neutral	
03-111	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 3		3-Gold	
03-113	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 3		3-Gold	



<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-114	25	[symbol] NO SMOKING 25 FEET FROM THIS AREA [symbol] NO BIKES [symbol] NO PETS [symbol] SURVEILLANCE THIS AREA IS SUBJECT TO SURVEILLANCE FOR SECURITY PURPOSES AND MAY OR MAY NOT BE MONITORED	Confirm with architect/owner whether plaque or glass-mounted vinyl version is to be used, as well as final field location.	0-Neutral	
03-115	50	BALCH HALL (Braille)		0-Neutral	
03-116	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 5 (Braille)		3-Gold	
03-117	18	FLOOR 3 (Braille)		3-Gold	
03-118	19	STAIR 5 NO ROOF ACCESS 3 FLOORS 2-5 EXIT FLOOR 2 (down arrow)		3-Gold	
03-119	50	STAIR 6 (Braille)		0-Neutral	
03-120	11	ROOF TERRACE (Braille)		3-Gold	
03-122	17A	STAIR 6 DOWN (Braille)		3-Gold	
03-123	17A	STAIR 6 UP ROOF TERRACE (Braille)		3-Gold	
03-125	18	FLOOR 3 (Braille)		3-Gold	
03-126	17A	STAIR 6 (Braille)		3-Gold	
03-130	51	SOUTH BALCH HALL (Braille)		0-Neutral	
03-131	25	[symbol] NO SMOKING 25 FEET FROM THIS AREA [symbol] NO BIKES [symbol] NO PETS [symbol] SURVEILLANCE THIS AREA IS SUBJECT TO SURVEILLANCE FOR SECURITY PURPOSES AND MAY OR MAY NOT BE MONITORED	Confirm with architect/owner whether plaque or glass-mounted vinyl version is to be used, as well as final field location.	0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-132	25	[symbol] NO SMOKING 25 FEET FROM THIS AREA [symbol] NO BIKES [symbol] NO PETS [symbol] SURVEILLANCE THIS AREA IS SUBJECT TO SURVEILLANCE FOR SECURITY PURPOSES AND MAY OR MAY NOT BE MONITORED	Confirm with architect/owner whether plaque or glass-mounted vinyl version is to be used, as well as final field location.	0-Neutral	
03-133	25	[symbol] NO SMOKING 25 FEET FROM THIS AREA [symbol] NO BIKES [symbol] NO PETS [symbol] SURVEILLANCE THIS AREA IS SUBJECT TO SURVEILLANCE FOR SECURITY PURPOSES AND MAY OR MAY NOT BE MONITORED	Confirm with architect/owner whether plaque or glass-mounted vinyl version is to be used, as well as final field location.	0-Neutral	
03-135	53	(accessible symbol)(right arrow)		0-Neutral	
03-136	11	3264 UNIT 4 LOUNGE (Braille)		4-Blue	
03-137	16B	(up-right arrow) (stair symbol) 3272-3296 (up arrow) (accessible symbol) Lift		4-Blue	
03-138	11	3275 KITCHEN (Braille)		4-Blue	Yes
03-139	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] STAIR 8 (Braille)		4-Blue	
03-141	16B	(up arrow) (stair symbol) 3201-3264 (stair symbol) Unit 4 Lounge (right arrow) (accessible symbol) Lift		4-Blue	
03-142	18	FLOOR 3 (Braille)		4-Blue	
03-143	14	(women/accessible symbol) 3272 BATH (Braille)		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-144	14	(women symbol) 3274 BATH (Braille)		4-Blue	
03-145	10	3276 (Braille)		4-Blue	
03-145A	15			0-Neutral	
03-146	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 7 (Braille)		4-Blue	
03-147	18	FLOOR 3 (Braille)		4-Blue	
03-148	19	STAIR 7 NO ROOF ACCESS 3 FLOORS 2-6 EXIT AT GROUND (down arrow)		4-Blue	
03-149	50	STAIR 7 (Braille)		0-Neutral	
03-150	20	EXIT (Braille)		4-Blue	
03-151	10	3278 (Braille)		4-Blue	
03-151A	15			0-Neutral	
03-152	10	3280 (Braille)		4-Blue	
03-152A	15			0-Neutral	
03-153	10	3282 (Braille)		4-Blue	
03-153A	15			0-Neutral	
03-154	10	3284 (Braille)		4-Blue	
03-154A	15			0-Neutral	
03-155	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] STAIR 8 (Braille)		4-Blue	
03-156	16A	(up arrow) 3272-3284 even		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-157	18	FLOOR 3 (Braille)		4-Blue	
03-158	19	STAIR 8 NO ROOF ACCESS 3 FLOORS 3-6 EXIT THIS FLOOR		4-Blue	
03-159	18	FLOOR 3 (Braille)		4-Blue	
03-160	16A	(up arrow) 3279, 3283 3287-3297 Elevator		4-Blue	
03-161	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] STAIR 8 (Braille)		4-Blue	
03-162	14A	(accessibility symbol) LIFT (Braille)		4-Blue	
03-163	12	30081 JANITOR (Braille)		4-Blue	
03-164	10	3279 (Braille)		4-Blue	
03-164A	15			0-Neutral	
03-165	10	3283 (Braille)		4-Blue	
03-165A	15			0-Neutral	
03-166	10	3287 (Braille)		4-Blue	
03-166A	15			0-Neutral	
03-167	12	30068 ELECTRICAL No Storage Allowed (Braille)		4-Blue	
03-168	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 3		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-169	16B	(left arrow) 3288-3296 (right arrow) 3201-3287		4-Blue	
03-170	14	(women/accessible symbol) 3286 BATH (Braille)		4-Blue	
03-171	14	(women symbol) 3289 BATH (Braille)		4-Blue	
03-172	12	3288 (Braille)		4-Blue	
03-173	10	3291 (Braille)		4-Blue	
03-173A	15			0-Neutral	
03-174	10	3290 (Braille)		4-Blue	
03-174A	15			0-Neutral	
03-175	10	3292 (Braille)		4-Blue	
03-175A	15			0-Neutral	
03-176	10	3293 (Braille)		4-Blue	
03-176A	15			0-Neutral	
03-177	10	3294 (Braille)		4-Blue	
03-177A	15			0-Neutral	
03-178	10	3295 (Braille)		4-Blue	
03-178A	15			0-Neutral	
03-179	12	#### TBD (Braille)		4-Blue	
03-180	10	3296 (Braille)		4-Blue	
03-180A	15			0-Neutral	
03-181	10	3297 (Braille)		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-181A	15			0-Neutral	
03-182	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 9 (Braille)		4-Blue	
03-183	18	FLOOR 3 (Braille)		4-Blue	
03-184	19	STAIR 9 NO ROOF ACCESS 3 FLOORS 3-5 EXIT THIS FLOOR		4-Blue	
03-185	20	EXIT (Braille)		4-Blue	
03-186	50	STAIR 9 (Braille)	alternate message: BALCH HALL (Braille) (blue accessible symbol)	0-Neutral	
03-191	20	EXIT (Braille)		2-Plum	
03-192	20	EXIT (Braille)		2-Plum	
03-193	20	EXIT (Braille)		4-Blue	
03-195	20	EXIT (Braille)		0-Neutral	
03-196	20	EXIT (Braille)		3-Gold	
03-197	20	EXIT (Braille)		3-Gold	
03-198	21	Maximum Occupancy 84		2-Plum	
03-199	21	Maximum Occupancy 53		4-Blue	
03-201	21	Maximum Occupancy 30		3-Gold	
03-202	21	Maximum Occupancy 38		1-Red	
03-203	21	Maximum Occupancy 52		2-Plum	
03-204	11	3210 UNIT 3 LOUNGE (Braille)		3-Gold	
03-205	11	3176 STUDY (Braille)		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
03-206	16D	(right arrow) (accessible symbol) Elevator		2-Plum	
03-207	16A	(up arrow) 3130A-3130G		1-Red	
03-208	10	3120 (Braille)		1-Red	
03-208A	15			0-Neutral	
03-209	10	3105 (Braille)		1-Red	
03-209A	15			0-Neutral	
03-210	16A	(up arrow) 3205A-3205E		3-Gold	
03-213	16D	(left arrow)(accessible symbol)Room 3184		2-Plum	
03-215	16D	(right arrow)(accessible symbol)Room 3168		1-Red	
03-900	99	TBD	Coordinate message and location with owner	0-	
03-901	99	TBD	Coordinate message and location with owner	0-	
04-001	10	4101 (Braille)		1-Red	
04-001A	15			0-Neutral	
04-002	10	4102 (Braille)		1-Red	
04-002A	15			0-Neutral	
04-003	10	4103 (Braille)		1-Red	
04-003A	15			0-Neutral	
04-004	10	4104 (Braille)		1-Red	
04-004A	15			0-Neutral	
04-005	10	4105 (Braille)		1-Red	
04-005A	15			0-Neutral	
04-006	10	4106 (Braille)		1-Red	
04-006A	15			0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-007	14	(women symbol) 4107 BATH (Braille)		1-Red	
04-008	10	4108 (Braille)		1-Red	
04-008A	15			0-Neutral	
04-009	16B	(left arrow) 4101-4108 4200s (right arrow) 4112-4140		1-Red	
04-010	10	4112 (Braille)		1-Red	
04-010A	15			0-Neutral	
04-011	16A	(up arrow) 4120A-4120E		1-Red	
04-012	14	(women/accessible symbol) 4120A BATH (Braille)		1-Red	
04-013	10	4120B (Braille)		1-Red	
04-013A	15			0-Neutral	
04-014	10	4120C (Braille)		1-Red	
04-014A	15			0-Neutral	
04-015	10	4120D (Braille)		1-Red	
04-015A	15			0-Neutral	
04-016	10	4120E (Braille)		1-Red	
04-016A	15			0-Neutral	
04-017	12	40080 JANITOR (Braille)		1-Red	
04-018	16A	(up arrow) 4130A-4130F		1-Red	
04-019	14	(women/accessible symbol) 4130A BATH (Braille)		1-Red	



<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-020	10	4130B (Braille)		1-Red	
04-020A	15			0-Neutral	
04-021	10	4130C (Braille)		1-Red	
04-021A	15			0-Neutral	
04-022	10	4130E (Braille)		1-Red	
04-022A	15			0-Neutral	
04-023	10	4130F (Braille)		1-Red	
04-023A	15			0-Neutral	
04-024	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 1 (Braille)		1-Red	
04-025	18	FLOOR 4 (Braille)		1-Red	
04-026	19	STAIR 1 NO ROOF ACCESS 4 FLOORS 1-5 EXIT AT GROUND (down arrow)		1-Red	
04-027	12	40061 ELECTRICAL No Storage Allowed (Braille)		1-Red	
04-028	12	40060 EMERGENCY ELECTRICAL No Storage Allowed (Braille)		1-Red	
04-029	11	4141 KITCHEN (Braille)		1-Red	Yes
04-030	16C	(left arrow) 4143-4173 (stair symbol) 4176-4195 (u-turn arrow) (accessible symbol) 4176-4195 Switch elevators on third floor (right arrow) 4101-4141 4200s		1-Red	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-031	21	Maximum Occpancy 28		1-Red	
04-032	11	4143 LOUNGE (Braille)		1-Red	
04-033	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 4		1-Red	
04-034	14	(women symbol) 4144 BATH (Braille)		1-Red	
04-035	10	4146 (Braille)		1-Red	
04-035A	15			0-Neutral	
04-036	10	4145 (Braille)		1-Red	
04-036A	15			0-Neutral	
04-037	10	4148 (Braille)		1-Red	
04-037A	15			0-Neutral	
04-038	10	4147 (Braille)		1-Red	
04-038A	15			0-Neutral	
04-039	10	4149 (Braille)		1-Red	
04-039A	15			0-Neutral	
04-040	10	4150 (Braille)		1-Red	
04-040A	15			0-Neutral	
04-041	10	4151 (Braille)		1-Red	
04-041A	15			0-Neutral	
04-042	12	40162 IT IDF (Braille)		1-Red	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-043	17A	STAIR 2 (Braille)		1-Red	
04-044	18	FLOOR 4 (Braille)		1-Red	
04-045	16A	(up arrow) 4101-4151 Elevator 4200s		1-Red	
04-046	16A	(up arrow) 4160A-4160E		2-Plum	
04-047	12	40163 IT SEC (Braille)		2-Plum	
04-048	10	4160A (Braille)		2-Plum	
04-048A	15			0-Neutral	
04-049	10	4158 (Braille)		2-Plum	
04-049A	15			0-Neutral	
04-050	10	4160 (Braille)		2-Plum	
04-050A	15			0-Neutral	
04-051	14	(women/accessible symbol) 4160E BATH (Braille)		2-Plum	
04-052	18	FLOOR 4 (Braille)		2-Plum	
04-053	16C	(up arrow) 4165-4173 (stair symbol) 4176-4195 (u-turn arrow) (accessible symbol) 4176-4195 Switch elevators on third floor		2-Plum	
04-054	17A	STAIR 2 (Braille)		2-Plum	
04-055	10	4165 (Braille)		2-Plum	
04-055A	15			0-Neutral	
04-056	14	(women/accessible symbol) 4166 BATH (Braille)		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-057	10	4167 (Braille)		2-Plum	
04-057A	15			0-Neutral	
04-058	10	4168 (Braille)		2-Plum	
04-058A	15			0-Neutral	
04-059	10	4169 (Braille)		2-Plum	
04-059A	15			0-Neutral	
04-060	10	4170 (Braille)		2-Plum	
04-060A	15			0-Neutral	
04-061	10	4171 (Braille)		2-Plum	
04-061A	15			0-Neutral	
04-062	10	4172 (Braille)		2-Plum	
04-062A	15			0-Neutral	
04-063	10	4173 (Braille)		2-Plum	
04-063A	15			0-Neutral	
04-064	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 3 (Braille)		2-Plum	
04-065	16B	(up arrow) (stair symbol) 4177-4195 (u-turn arrow) (accessible symbol) Elevator Switch elevators on third floor		2-Plum	
04-066	18	FLOOR 4 4101-4173 (Braille)		2-Plum	
04-067	19	STAIR 3 NO ROOF ACCESS 4 FLOORS 2-6 EXIT FLOOR 2 (down arrow)		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-068	19	STAIR 3 NO ROOF ACCESS 4 FLOORS 2-6 EXIT FLOOR 2 (down arrow)		2-Plum	
04-069	18	FLOOR 4 4176-4195 (Braille)		2-Plum	
04-070	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 3 (Braille)		2-Plum	
04-071	16B	(up arrow) (stair symbol) 4101-4173 (stair symbol) 4200s (right arrow) (accessible symbol) Elevator Switch elevators on 3rd floor		2-Plum	
04-072	16A	(up arrow) 4185A-4185E		2-Plum	
04-073	14	(women/accessible symbol) 4185E BATH (Braille)		2-Plum	
04-074	10	4185D (Braille)		2-Plum	
04-074A	15			0-Neutral	
04-075	10	4185C (Braille)		2-Plum	
04-075A	15			0-Neutral	
04-076	10	4185B (Braille)		2-Plum	
04-076A	15			0-Neutral	
04-077	10	4185A (Braille)		2-Plum	
04-077A	15			0-Neutral	
04-078	11	4191 KITCHEN (Braille)		2-Plum	Yes
04-079	21	Maximum Occupancy 23		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-080	11	4176 LOUNGE (Braille)		2-Plum	
04-081	16A	(up arrow) 4195A-4195G		2-Plum	
04-082	10	4195G (Braille)		2-Plum	
04-082A	15			0-Neutral	
04-083	10	4195F (Braille)		2-Plum	
04-083A	15			0-Neutral	
04-084	10	4195E (Braille)		2-Plum	
04-084A	15			0-Neutral	
04-085	10	4195D (Braille)		2-Plum	
04-085A	15			0-Neutral	
04-086	10	4195C (Braille)		2-Plum	
04-086A	15			0-Neutral	
04-087	10	4195B (Braille)		2-Plum	
04-087A	15			0-Neutral	
04-088	10	4195A (Braille)		2-Plum	
04-088A	15			0-Neutral	
04-089	16C	(left arrow) 4180-4188 even (right arrow) 4185-4191 odd (up arrow) 4195		2-Plum	
04-090	14	(women/accessible symbol) 4188 BATH (Braille)		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-091	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 4		2-Plum	
04-092	10	4186 (Braille)		2-Plum	
04-092A	15			0-Neutral	
04-093	10	4180 (Braille)		2-Plum	
04-093A	15			0-Neutral	
04-094	10	4184 (Braille)		2-Plum	
04-094A	15			0-Neutral	
04-095	10	4182 (Braille)		2-Plum	
04-095A	15			0-Neutral	
04-096	12	40064 ELECTRICAL No Storage Allowed (Braille)		2-Plum	
04-097	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 4 (Braille)		2-Plum	
04-098	18	FLOOR 4 (Braille)		2-Plum	
04-099	19	STAIR 4 NO ROOF ACCESS 4 FLOORS 3-6 EXIT FLOOR 3 (down arrow)		2-Plum	
04-100	10	4201 (Braille)		3-Gold	
04-100A	15			0-Neutral	
04-101	10	4202 (Braille)		3-Gold	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-101A	15			0-Neutral	
04-102	10	4203 (Braille)		3-Gold	
04-102A	15			0-Neutral	
04-103	10	4204 (Braille)		3-Gold	
04-103A	15			0-Neutral	
04-104	14	(women symbol) 4205 BATH (Braille)		3-Gold	
04-105	10	4206 (Braille)		3-Gold	
04-105A	15			0-Neutral	
04-106	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 4		3-Gold	
04-107	16A	(up arrow) 4201-4206 4100s		3-Gold	
04-108	10	4208 (Braille)		3-Gold	
04-108A	15			0-Neutral	
04-109	10	4212 (Braille)		3-Gold	
04-109A	15			0-Neutral	
04-110	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 5 (Braille)		3-Gold	
04-111	18	FLOOR 4 (Braille)		3-Gold	



<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-112	19	STAIR 5 NO ROOF ACCESS 4 FLOORS 2-5 EXIT FLOOR 2 (down arrow)		3-Gold	
04-113	16A	(up arrow) 4209 4220-4297		3-Gold	
04-114	12	40260 ELECTRICAL No Storage Allowed (Braille)		3-Gold	
04-115	12	40261 EMERGENCY ELECTRICAL No Storage Allowed (Braille)		3-Gold	
04-116	10	4209 (Braille)		3-Gold	
04-116A	15			0-Neutral	
04-117	16A	(up arrow) 4220A-4220F		3-Gold	
04-118	14	(women/accessible symbol) 4220F BATH (Braille)		3-Gold	
04-119	10	4220E (Braille)		3-Gold	
04-119A	15			0-Neutral	
04-120	10	4220D (Braille)		3-Gold	
04-120A	15			0-Neutral	
04-121	10	4220C (Braille)		3-Gold	
04-121A	15			0-Neutral	
04-122	10	4220B (Braille)		3-Gold	
04-122A	15			0-Neutral	
04-123	10	4220A (Braille)		3-Gold	
04-123A	15			0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-124	11	4236 LOUNGE (Braille)		3-Gold	
04-125	21	Maximum Occupancy 37		3-Gold	
04-126	16B	(left arrow) 4240-4297 (up arrow) 4201-4220 4100s Elevator		3-Gold	
04-127	11	4240 KITCHEN (Braille)		3-Gold	Yes
04-128	14	(women symbol) 4241 BATH (Braille)		3-Gold	
04-129	10	4244 (Braille)		3-Gold	
04-129A	15			0-Neutral	
04-130	10	4243 (Braille)		3-Gold	
04-130A	15			0-Neutral	
04-131	10	4246 (Braille)		3-Gold	
04-131A	15			0-Neutral	
04-132	10	4245 (Braille)		3-Gold	
04-132A	15			0-Neutral	
04-133	10	4248 (Braille)		3-Gold	
04-133A	15			0-Neutral	
04-134	10	4249 (Braille)		3-Gold	
04-134A	15			0-Neutral	
04-135	10	4250 (Braille)		3-Gold	
04-135A	15			0-Neutral	
04-136	17A	STAIR 6 (Braille)		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-137	18	FLOOR 4 (Braille)		4-Blue	
04-138	10	4252 (Braille)		4-Blue	
04-138A	15			0-Neutral	
04-139	10	4253 (Braille)		4-Blue	
04-139A	15			0-Neutral	
04-140	12	40081 JANITOR (Braille)		4-Blue	
04-141	10	4258 (Braille)		4-Blue	
04-141A	15			0-Neutral	
04-142	10	4260 (Braille)		4-Blue	
04-142A	15			0-Neutral	
04-143	14	(women symbol) 4262 BATH (Braille)		4-Blue	
04-144	10	4259 (Braille)		4-Blue	
04-144A	15			0-Neutral	
04-145	12	40266 SEC (Braille)		4-Blue	
04-146	12	4263 IT IDF (Braille)		4-Blue	
04-147	10	4264 (Braille)		4-Blue	
04-147A	15			0-Neutral	
04-148	10	4265 (Braille)		4-Blue	
04-148A	15			0-Neutral	
04-149	10	4266 (Braille)		4-Blue	
04-149A	15			0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-150	10	4267 (Braille)		4-Blue	
04-150A	15			0-Neutral	
04-151	10	4269 (Braille)		4-Blue	
04-151A	15			0-Neutral	
04-152	10	4268 (Braille)		4-Blue	
04-152A	15			0-Neutral	
04-153	10	4270 (Braille)		4-Blue	
04-153A	15			0-Neutral	
04-154	10	4271 (Braille)		4-Blue	
04-154A	15			0-Neutral	
04-155	11	4277A KITCHEN (Braille)		4-Blue	Yes
04-156	16B	(right arrow) 4201-4271 4100s (left arrow) 4280-4297		4-Blue	
04-157	16A	(up arrow) 4280A-4820F		4-Blue	
04-158	14	(women/accessible symbol) 4280F BATH (Braille)		4-Blue	
04-159	10	4280E (Braille)		4-Blue	
04-159A	15			0-Neutral	
04-160	10	4280D (Braille)		4-Blue	
04-160A	15			0-Neutral	
04-161	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 7 (Braille)		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-162	18	FLOOR 4 (Braille)		4-Blue	
04-163	19	STAIR 7 NO ROOF ACCESS 4 FLOORS 2-6 EXIT AT GROUND (down arrow)		4-Blue	
04-164	10	4280C (Braille)		4-Blue	
04-164A	15			0-Neutral	
04-165	10	4280B (Braille)		4-Blue	
04-165A	15			0-Neutral	
04-166	10	4280A (Braille)		4-Blue	
04-166A	15			0-Neutral	
04-167	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 8 (Braille)		4-Blue	
04-168	16A	(up arrow) 4277-4283 odd 4286-4297 Elevator		4-Blue	
04-169	16A	(up arrow) 4201-4271 4280-4284 even 4100s		4-Blue	
04-170	18	FLOOR 4 (Braille)		4-Blue	
04-171	19	STAIR 8 NO ROOF ACCESS 4 FLOORS 3-6 EXIT FLOOR 3 (down arrow)		4-Blue	
04-172	16A	(up arrow) 4277-4283 odd 4286-4297		4-Blue	
04-173	18	FLOOR 4 (Braille)		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-174	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 8 (Braille)		4-Blue	
04-175	11	4277A KITCHEN (Braille)		4-Blue	Yes
04-176	11	4277 LOUNGE (Braille)		4-Blue	Yes
04-177	12	40068 ELECTRICAL No Storage Allowed (Braille)		4-Blue	
04-178	21	Maximum Occupancy 23		4-Blue	
04-179	11	4277 LOUNGE (Braille)		4-Blue	
04-180	10	4279 (Braille)		4-Blue	
04-180A	15			0-Neutral	
04-181	10	4283 (Braille)		4-Blue	
04-181A	15			0-Neutral	
04-182	10	4287 (Braille)		4-Blue	
04-182A	15			0-Neutral	
04-183	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 4		4-Blue	
04-184	14	(women/accessible symbol) 4286 BATH (Braille)		4-Blue	
04-185	16B	(left arrow) 4288-4297 (right arrow) 4201-4287 4100s		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-186	14	(women symbol) 4289 BATH (Braille)		4-Blue	
04-187	10	4288 (Braille)		4-Blue	
04-187A	15			0-Neutral	
04-188	10	4291 (Braille)		4-Blue	
04-188A	15			0-Neutral	
04-189	10	4290 (Braille)		4-Blue	
04-189A	15			0-Neutral	
04-190	10	4292 (Braille)		4-Blue	
04-190A	15			0-Neutral	
04-191	10	4293 (Braille)		4-Blue	
04-191A	15			0-Neutral	
04-192	10	4295 (Braille)		4-Blue	
04-192A	15			0-Neutral	
04-193	10	4294 (Braille)		4-Blue	
04-193A	15			0-Neutral	
04-194	10	4297 (Braille)		4-Blue	
04-194A	15			0-Neutral	
04-195	10	4296 (Braille)		4-Blue	
04-195A	15			0-Neutral	
04-196	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 9 (Braille)		4-Blue	
04-197	18	FLOOR 4 (Braille)		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
04-198	19	STAIR 9 NO ROOF ACCESS 4 FLOORS 3-5 EXIT FLOOR 3 (down arrow)		4-Blue	
04-199	16D	(right arrow)(accessible symbol)Room 4166		1-Red	
04-200	16D	(left arrow)(accessible symbol)Room 4166		1-Red	
04-201	16D	(left arrow)(accessible symbol)Room 4166		3-Gold	
04-202	16D	(left arrow)(accessible symbol)Room 4166		3-Gold	
04-203	16D	(left arrow)(accessible symbol)Room 4166		4-Blue	
05-001	10	5101 (Braille)		1-Red	
05-001A	15			0-Neutral	
05-002	10	5103 (Braille)		1-Red	
05-002A	15			0-Neutral	
05-003	10	5107 (Braille)		1-Red	
05-003A	15			0-Neutral	
05-004	14	(women/accessible symbol) 5109 BATH (Braille)		1-Red	
05-005	10	5108 (Braille)		1-Red	
05-005A	15			0-Neutral	
05-006	11	5112 LOUNGE (Braille)		1-Red	
05-007	11	5114 KITCHEN (Braille)		1-Red	
05-008	12	50070 ELEVATOR CONTROL ROOM (No Storage Allowed) (Braille)		1-Red	



<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-009	31	ELEVATOR CONTROL ROOM NO STORAGE ALLOWED		1-Red	
05-010	12	5116 STORAGE (Braille)		1-Red	
05-011	12	ATTIC (Braille)		1-Red	
05-012	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 1 (Braille)		1-Red	
05-013	18	FLOOR 5 (Braille)		1-Red	
05-014	19	STAIR 1 NO ROOF ACCESS 5 FLOORS 1-5 EXIT AT GROUND (down arrow)		1-Red	
05-015	12	50061 ELECTRICAL No Storage Allowed (Braille)		1-Red	
05-016	12	50060 EMERGENCY ELECTRICAL No Storage Allowed (Braille)		1-Red	
05-017	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 5		1-Red	
05-018	12	50080 JANITOR (Braille)		1-Red	
05-019	16C	(left arrow) 5143-5175 (stair symbol) 5176-5195 (u-turn arrow) (accessible symbol) 5176-5195 Switch elevators on third floor (right arrow) 5101-5114 5200s		1-Red	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-020	10	5143 (Braille)		1-Red	
05-020A	15			0-Neutral	
05-021	14	(women symbol) 5144 BATH (Braille)		1-Red	
05-022	10	5146 (Braille)		1-Red	
05-022A	15			0-Neutral	
05-023	10	5145 (Braille)		1-Red	
05-023A	15			0-Neutral	
05-024	10	5148 (Braille)		1-Red	
05-024A	15			0-Neutral	
05-025	10	5147 (Braille)		1-Red	
05-025A	15			0-Neutral	
05-026	10	5152 (Braille)		1-Red	
05-026A	15			0-Neutral	
05-027	10	5151 (Braille)		1-Red	
05-027A	15			0-Neutral	
05-028	17A	STAIR 2 (Braille)		1-Red	
05-029	16A	(up arrow) 5101-5152 Elevator 5200s		1-Red	
05-030	18	FLOOR 5 (Braille)		1-Red	
05-031	12	5160 STORAGE (Braille)		0-Neutral	
05-032	12	50163 IT SEC (Braille)		0-Neutral	
05-033	18	FLOOR 5 (Braille)		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-034	16B	(up arrow) 5163-4175 (stair symbol) 5176-5195 (u-turn arrow) (accessible symbol) 5176-5195 Switch elevators on third floor		2-Plum	
05-035	17A	STAIR 2 (Braille)		2-Plum	
05-036	10	5163 (Braille)		2-Plum	
05-036A	15			0-Neutral	
05-037	10	5166 (Braille)		2-Plum	
05-037A	15			0-Neutral	
05-038	10	5167 (Braille)		2-Plum	
05-038A	15			0-Neutral	
05-039	10	5170 (Braille)		2-Plum	
05-039A	15			0-Neutral	
05-040	10	5169 (Braille)		2-Plum	
05-040A	15			0-Neutral	
05-041	10	5172 (Braille)		2-Plum	
05-041A	15			0-Neutral	
05-042	10	5173 (Braille)		2-Plum	
05-042A	15			0-Neutral	
05-043	10	5174 (Braille)		2-Plum	
05-043A	15			0-Neutral	
05-044	14	(women symbol) 5157 RESTROOM (Braille)		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-045	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 3 (Braille)		2-Plum	
05-046	16B	(up arrow) (stair symbol) 5177-5195 (u-turn arrow) (accessible symbol) Elevator Switch elevators on third floor		2-Plum	
05-047	18	FLOOR 5 5101-5175 (Braille)		2-Plum	
05-048	19	STAIR 3 NO ROOF ACCESS 5 FLOORS 2-6 EXIT FLOOR 2 (down arrow)		2-Plum	
05-049	19	STAIR 3 NO ROOF ACCESS 5 FLOORS 2-6 EXIT FLOOR 2 (down arrow)		2-Plum	
05-050	18	FLOOR 5 5176-5195 (Braille)		2-Plum	
05-051	16B	(up arrow) (stair symbol) 5101-5175 (stair symbol) 5200s (right arrow) (accessible symbol) Elevator Switch elevators on 3rd floor		2-Plum	
05-052	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 3 (Braille)		2-Plum	
05-053	16A	(up arrow) 5185A-5185E		2-Plum	
05-054	14	(women/accessible symbol) 5185E BATH (Braille)		2-Plum	
05-055	10	5185D (Braille)		2-Plum	
05-055A	15			0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-056	10	5185C (Braille)		2-Plum	
05-056A	15			0-Neutral	
05-057	10	5185B (Braille)		2-Plum	
05-057A	15			0-Neutral	
05-058	10	5185A (Braille)		2-Plum	
05-058A	15			0-Neutral	
05-059	21	Maximum Occupancy 25		2-Plum	
05-060	11	5176 LOUNGE (Braille)		2-Plum	
05-061	11	5191 KITCHEN (Braille)		2-Plum	Yes
05-062	16C	(left arrow) 5180-5190 even (right arrow) 5177-5191 odd (up arrow) 5192-5195		2-Plum	
05-063	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 5		2-Plum	
05-064	10	5180 (Braille)		2-Plum	
05-064A	15			0-Neutral	
05-065	10	5182 (Braille)		2-Plum	
05-065A	15			0-Neutral	
05-066	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 4 (Braille)		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-067	18	FLOOR 5 (Braille)		2-Plum	
05-068	19	STAIR 4 NO ROOF ACCESS 5 FLOORS 3-6 EXIT FLOOR 3 (down arrow)		2-Plum	
05-069	12	50063 ELECTRICAL No Storage Allowed (Braille)		2-Plum	
05-070	10	5184 (Braille)		2-Plum	
05-070A	15			0-Neutral	
05-071	10	5186 (Braille)		2-Plum	
05-071A	15			0-Neutral	
05-072	14	(women/accessible symbol) 5190 BATH (Braille)		2-Plum	
05-073	16A	(up arrow) 5195A-4195G		2-Plum	
05-074	10	5195A (Braille)		2-Plum	
05-074A	15			0-Neutral	
05-075	10	5195G (Braille)		2-Plum	
05-075A	15			0-Neutral	
05-076	10	5195F (Braille)		2-Plum	
05-076A	15			0-Neutral	
05-077	10	5195B (Braille)		2-Plum	
05-077A	15			0-Neutral	
05-078	10	5195E (Braille)		2-Plum	
05-078A	15			0-Neutral	
05-079	10	5195C (Braille)		2-Plum	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-079A	15			0-Neutral	
05-080	10	5195D (Braille)		2-Plum	
05-080A	15			0-Neutral	
05-081	10	5201 (Braille)		3-Gold	
05-081A	15			0-Neutral	
05-082	10	5203 (Braille)		3-Gold	
05-082A	15			0-Neutral	
05-083	14	(women symbol) 5205 BATH (Braille)		3-Gold	
05-084	16B	(right arrow) 5201-5205 5100s (left arrow) 5206-5297		3-Gold	
05-085	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 5		3-Gold	
05-086	10	5208 (Braille)		3-Gold	
05-086A	15			0-Neutral	
05-087	16B	(right arrow) 5201-5210 5100s (left arrow) 5212-5297		3-Gold	
05-088	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 5 (Braille)		3-Gold	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-089	19	STAIR 5 NO ROOF ACCESS 5 FLOORS 2-5 EXIT FLOOR 2 (down arrow)		3-Gold	
05-090	18	FLOOR 5 (Braille)		3-Gold	
05-091	10	5212 (Braille)		3-Gold	
05-091A	15			0-Neutral	
05-092	12	50067 ELECTRICAL No Storage Allowed (Braille)		3-Gold	
05-093	12	50066 EMERGENCY ELECTRICAL No Storage Allowed (Braille)		3-Gold	
05-094	11	5214 KITCHEN (Braille)		3-Gold	Yes
05-095	31	ELEVATOR CONTROL ROOM NO STORAGE ALLOWED		3-Gold	
05-096	12	50075 ELEVATOR CONTROL ROOM No Storage Allowed (Braille)		3-Gold	
05-097	12	5216 STORAGE (Braille)		3-Gold	
05-098	11	5236 LOUNGE (Braille)		3-Gold	
05-099	10	5240 (Braille)		3-Gold	
05-099A	15			0-Neutral	
05-100	14	(women/accessible symbol) 5241 BATH (Braille)		3-Gold	
05-101	10	5243 (Braille)		3-Gold	
05-101A	15			0-Neutral	



<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-102	10	5244 (Braille)		3-Gold	
05-102A	15			0-Neutral	
05-103	10	5245 (Braille)		3-Gold	
05-103A	15			0-Neutral	
05-104	10	5246 (Braille)		3-Gold	
05-104A	15			0-Neutral	
05-105	10	5249 (Braille)		3-Gold	
05-105A	15			0-Neutral	
05-106	10	5248 (Braille)		3-Gold	
05-106A	15			0-Neutral	
05-107	17A	STAIR 6 (Braille)		4-Blue	
05-108	18	FLOOR 5 (Braille)		4-Blue	
05-109	10	5250 (Braille)		4-Blue	
05-109A	15			0-Neutral	
05-110	16B	(right arrow) 5201-5250 5100s (left arrow) 5252-5297		4-Blue	
05-111	10	5252 (Braille)		4-Blue	
05-111A	15			0-Neutral	
05-112	10	5259 (Braille)		4-Blue	
05-112A	15			0-Neutral	
05-113	12	50081 JANITOR (Braille)		4-Blue	
05-114	10	5263 (Braille)		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-114A	15			0-Neutral	
05-115	14	(women/accessible symbol) 5254 BATH (Braille)		4-Blue	
05-116	10	5258 (Braille)		4-Blue	
05-116A	15			0-Neutral	
05-117	10	5260 (Braille)		4-Blue	
05-117A	15			0-Neutral	
05-118	14	(women symbol) 5262 BATH (Braille)		4-Blue	
05-119	10	5265 (Braille)		4-Blue	
05-119A	15			0-Neutral	
05-120	12	50266 IT SEC (Braille)		4-Blue	
05-121	10	5264 (Braille)		4-Blue	
05-121A	15			0-Neutral	
05-122	10	5266 (Braille)		4-Blue	
05-122A	15			0-Neutral	
05-123	10	5267 (Braille)		4-Blue	
05-123A	15			0-Neutral	
05-124	10	5269 (Braille)		4-Blue	
05-124A	15			0-Neutral	
05-125	10	5268 (Braille)		4-Blue	
05-125A	15			0-Neutral	
05-126	10	5271 (Braille)		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-126A	15			0-Neutral	
05-127	10	5270 (Braille)		4-Blue	
05-127A	15			0-Neutral	
05-128	11	5277A KITCHEN (Braille)		4-Blue	Yes
05-129	16B	(right arrow) 5201-5271 (left arrow) 5279-5297		4-Blue	
05-130	16A	(up arrow) 5280A-5280F		4-Blue	
05-131	14	(women/accessible symbol) 5280E BATH (Braille)		4-Blue	
05-132	10	5280E (Braille)		4-Blue	
05-132A	15			0-Neutral	
05-133	10	5280D (Braille)		4-Blue	
05-133A	15			0-Neutral	
05-134	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 7 (Braille)		4-Blue	
05-135	18	FLOOR 5 (Braille)		4-Blue	
05-136	19	STAIR 7 NO ROOF ACCESS 5 FLOORS 2-6 EXIT AT GROUND (down arrow)		4-Blue	
05-137	10	5280C (Braille)		4-Blue	
05-137A	15			0-Neutral	
05-138	10	5280B (Braille)		4-Blue	
05-138A	15			0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-139	10	5280A (Braille)		4-Blue	
05-139A	15			0-Neutral	
05-140	10	5284 (Braille)		4-Blue	
05-140A	15			0-Neutral	
05-141	16A	(up arrow) 5277-5283 odd 5286-5297 Elevator		4-Blue	
05-142	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 8 (Braille)		4-Blue	
05-143	16A	(up arrow) 5201-5276 5278-5284 even 5100s		4-Blue	
05-144	18	FLOOR 5 (Braille)		4-Blue	
05-145	19	STAIR 8 NO ROOF ACCESS 5 FLOORS 3-6 EXIT FLOOR 3 (down arrow)		4-Blue	
05-146	16A	(up arrow) 5277-5283 odd 5286-5297 Elevator		4-Blue	
05-147	18	FLOOR 5 (Braille)		4-Blue	
05-148	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 8 (Braille)		4-Blue	
05-149	16A	(up arrow) 5201-5276 5278-5284 even 5100s		4-Blue	
05-150	12	50068 ELECTRICAL No Storage Allowed (Braille)		4-Blue	
05-151	11	5277A KITCHEN (Braille)		4-Blue	Yes

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-152	11	5277 LOUNGE (Braille)		4-Blue	Yes
05-153	21	Maximum Occupancy 23		4-Blue	
05-154	11	5277 LOUNGE (Braille)		4-Blue	
05-155	10	5279 (Braille)		4-Blue	
05-155A	15			0-Neutral	
05-156	10	5283 (Braille)		4-Blue	
05-156A	15			0-Neutral	
05-157	10	5287 (Braille)		4-Blue	
05-157A	15			0-Neutral	
05-158	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 5		4-Blue	
05-159	16B	(left arrow) 5290-5296 (up arrow) 5201-5277 5100s		4-Blue	
05-160	14	(women symbol) 5286 BATH (Braille)		4-Blue	
05-161	14	(women/accessible symbol) 5289 BATH (Braille)		4-Blue	
05-162	10	5291 (Braille)		4-Blue	
05-162A	15			0-Neutral	
05-163	10	5290 (Braille)		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
05-163A	15			0-Neutral	
05-164	10	5293 (Braille)		4-Blue	
05-164A	15			0-Neutral	
05-165	10	5292 (Braille)		4-Blue	
05-165A	15			0-Neutral	
05-166	10	5294 (Braille)		4-Blue	
05-166A	15			0-Neutral	
05-167	10	5297 (Braille)		4-Blue	
05-167A	15			0-Neutral	
05-168	10	5296 (Braille)		4-Blue	
05-168A	15			0-Neutral	
05-169	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 9 (Braille)		4-Blue	
05-170	18	FLOOR 5 (Braille)		4-Blue	
05-171	19	STAIR 9 NO ROOF ACCESS 5 FLOORS 3-5 EXIT FLOOR 3 (down arrow)		4-Blue	
05-172	16D	(right arrow)(accessible symbol)Room 5241		3-Gold	
05-173	16D	(right arrow)(accessible symbol)Room 5254		4-Blue	
05-174	16D	(right arrow)(accessible symbol)Room 5109		2-Plum	
05-175	16D	(left arrow)(accessible symbol)Room 5109		1-Red	
06-001	10	6185C (Braille)		2-Plum	
06-001A	15			0-Neutral	


<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
06-002	10	6185B (Braille)		2-Plum	
06-002A	15			0-Neutral	
06-003	10	6185A (Braille)		2-Plum	
06-003A	15			0-Neutral	
06-004	16A	(up arrow) 6185A-6185C		2-Plum	
06-005	12	60080 JANITOR (Braille)		2-Plum	
06-006	14	(women/accessible symbol) 6189 BATH (Braille)		2-Plum	
06-007	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 3 (Braille)		2-Plum	
06-008	18	FLOOR 6 (Braille)		2-Plum	
06-009	19	STAIR 3 NO ROOF ACCESS 6 FLOORS 2-6 EXIT FLOOR 2 (down arrow)		2-Plum	
06-010	21	Maximum Occupancy 24		2-Plum	
06-011	11	6176 LOUNGE (Braille)		2-Plum	
06-012	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 6		2-Plum	
06-013	10	#### (Braille)		2-Plum	
06-013A	15			0-Neutral	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
06-014	10	6182 (Braille)		2-Plum	
06-014A	15			0-Neutral	
06-015	19	STAIR 4 NO ROOF ACCESS 6 FLOORS 3-6 EXIT FLOOR 3 (down arrow)		2-Plum	
06-016	18	FLOOR 6 (Braille)		2-Plum	
06-017	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 4 (Braille)		2-Plum	
06-018	12	60164 ELECTRICAL No Storage Allowed (Braille)		2-Plum	
06-019	10	6184 (Braille)		2-Plum	
06-019A	15			0-Neutral	
06-020	10	6188 (Braille)		2-Plum	
06-020A	15			0-Neutral	
06-021	11	6190 KITCHEN (Braille)		2-Plum	Yes
06-022	16C	(left arrow) 6180-6190 even (right arrow) 6185-6189 odd (up arrow) 6191-6195		2-Plum	
06-023	12	60071 ELEVATOR CONTROL ROOM No Storage Allowed (Braille)		2-Plum	
06-024	31	ELEVATOR CONTROL ROOM NO STORAGE ALLOWED		2-Plum	
06-025	14	(women symbol) 6191 BATH (Braille)		2-Plum	



<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
06-026	16A	(up arrow) 6195A-6195E		2-Plum	
06-027	10	6195A (Braille)		2-Plum	
06-027A	15			0-Neutral	
06-028	10	6195E (Braille)		2-Plum	
06-028A	15			0-Neutral	
06-029	10	6195B (Braille)		2-Plum	
06-029A	15			0-Neutral	
06-030	10	6195D (Braille)		2-Plum	
06-030A	15			0-Neutral	
06-031	10	6195C (Braille)		2-Plum	
06-031A	15			0-Neutral	
06-032	10	6287 (Braille)		4-Blue	
06-032A	15			0-Neutral	
06-033	10	6283 (Braille)		4-Blue	
06-033A	15			0-Neutral	
06-034	30	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] (fire stair symbol) IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS. 6		4-Blue	
06-035	10	6279 (Braille)		4-Blue	
06-035A	15			0-Neutral	
06-036	14	(women/accessible symbol) 6286 BATH (Braille)		4-Blue	

<b>Number</b>	<b>Type</b>	<b>Message</b>	<b>Notes</b>	<b>Unit Color</b>	<b>Glass Backer</b>
06-037	12	60068 ELECTRICAL No Storage Allowed (Braille)		4-Blue	
06-039	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 8 (Braille)		4-Blue	
06-040	16A	(up arrow) 6272-6278 6280, 6284		4-Blue	
06-041	18	FLOOR 6 (Braille)		4-Blue	
06-042	16A	(up arrow) 6279, 6283 6286-6287 Elevator		4-Blue	
06-043	19	STAIR 8 NO ROOF ACCESS 6 FLOORS 3-6 EXIT FLOOR 3 (down arrow)		4-Blue	
06-045	16A	(up arrow) 6272-6278 6280, 6284		4-Blue	
06-046	18	FLOOR 6 (Braille)		4-Blue	
06-047	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 8 (Braille)		4-Blue	
06-048	16A	(up arrow) 6279, 6283 6286-6287 Elevator		4-Blue	
06-049	10	6284 (Braille)		4-Blue	
06-049A	15			0-Neutral	
06-050	10	6280 (Braille)		4-Blue	
06-050A	15			0-Neutral	
06-051	10	6278 (Braille)		4-Blue	
06-051A	15			0-Neutral	

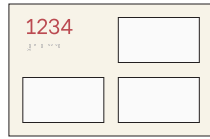
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06-052	17	[8.5x11 paper insert: 911 Instructions] [8.5x11 paper insert: Egress Map] EXIT STAIR 7 (Braille)		4-Blue	
06-053	18	FLOOR 6 (Braille)		4-Blue	
06-054	19	STAIR 7 NO ROOF ACCESS 6 FLOORS 2-6 EXIT AT GROUND (down arrow)		4-Blue	
06-055	10	6276 (Braille)		4-Blue	
06-055A	15			0-Neutral	
06-056	14	(women/accessible symbol) 6272 BATH (Braille)		4-Blue	
06-057	12	60081 JANITOR (Braille)		4-Blue	
06-058	12	60076 ELEVATOR CONTROL ROOM No Storage Allowed (Braille)		4-Blue	
06-059	31	ELEVATOR CONTROL ROOM NO STORAGE ALLOWED		4-Blue	
06-060	12	ATTIC (Braille)		4-Blue	
06-061	11	6277 LOUNGE (Braille)		4-Blue	
06-062	21	Maximum Occupancy 18		4-Blue	
06-063	11	6277A KITCHEN (Braille)		4-Blue	Yes
06-064	16D	(right arrow)(accessible symbol)Room 6189		2-Plum	
XX-002	24	EMERGENCY WAITING AREA To operate phone press And wait for response. Your location is  Elevator X Floor X.	Hold quantity, location TBD	1-Red	



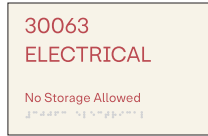
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11



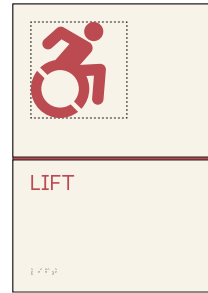
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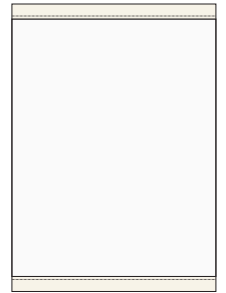
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14

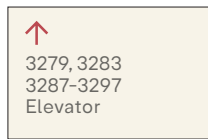


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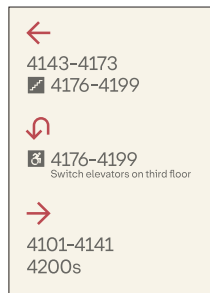


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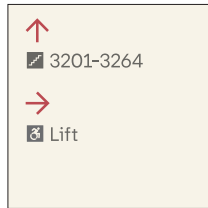
Under the law, all individuals have the right to use this single-sex facility consistent with their gender identity or expression.



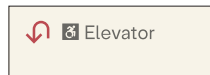
16A



16C



16B



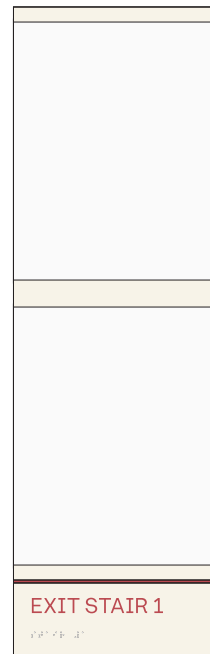
16D



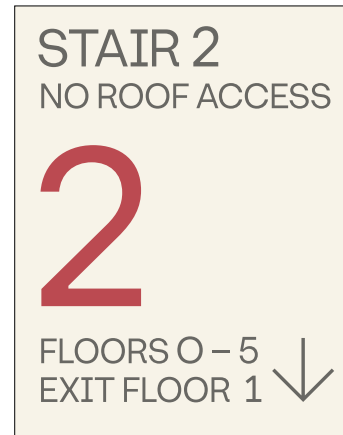
17A



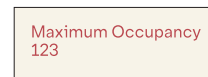
18



17



19

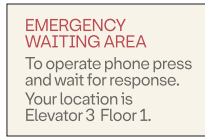


21

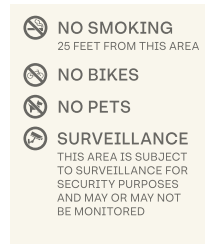




23



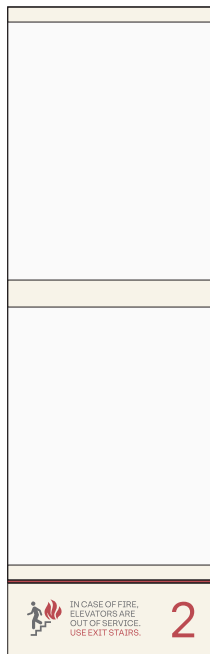
24



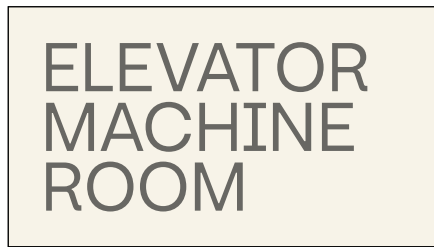
25



25 alternate



30



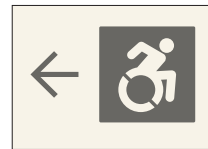
31



50



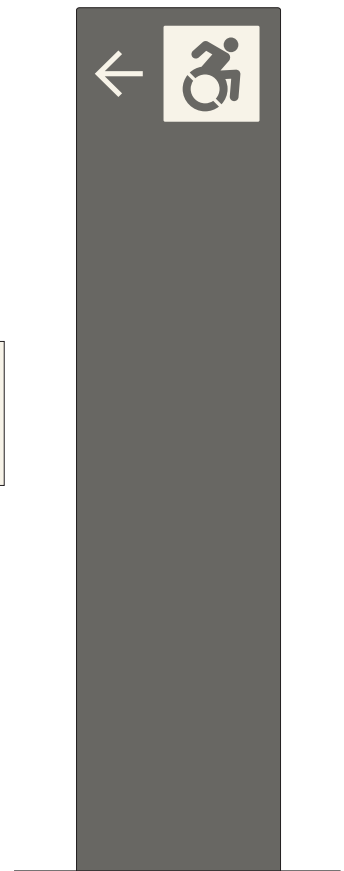
52



53



51



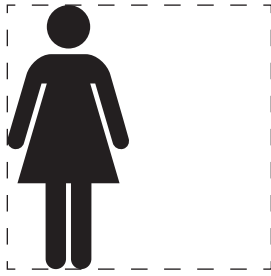
54



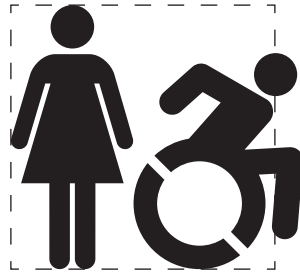
60



Symbols



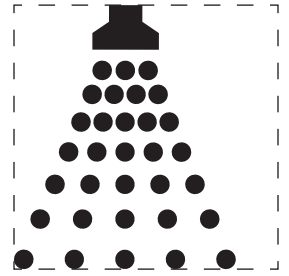
Women



Women/Accessible



Men/Accessible



Shower



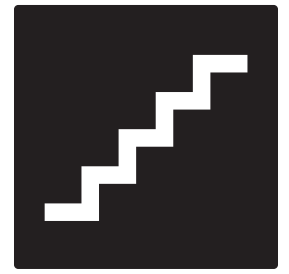
Accessible



Blue Accessible



Accessible-inline



Stair-inline



No Smoking



No Bikes



No Pets



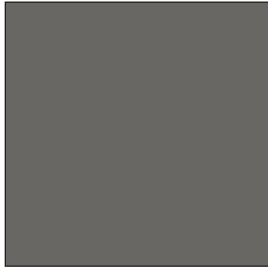
Surveillance



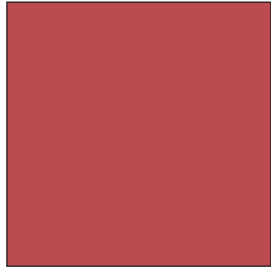
In Case of Fire



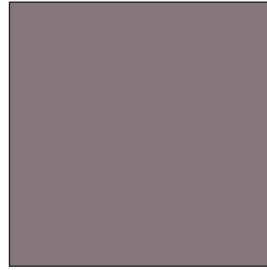
**Colors & Finishes**



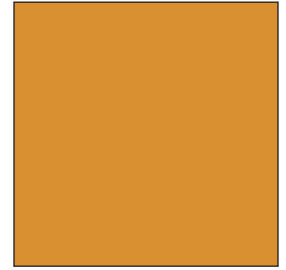
P0: BM HC-166  
Neutral accent



P1: SW6593 Coral Bells  
Unit 1 accent



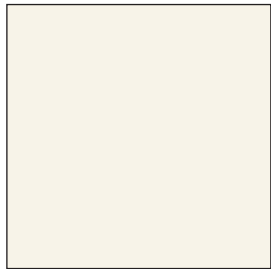
P2: SW6270 Soulmate  
Unit 2 accent



P3: SW6671 Curry  
Unit 3 accent



P4: SW9140 Blustery Sky  
Unit 4 accent

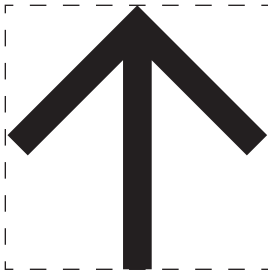


P5: SW7102 White Flour  
Base

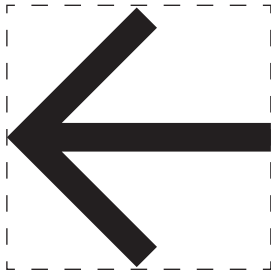


P7: Pantone 2935C  
Accessible blue

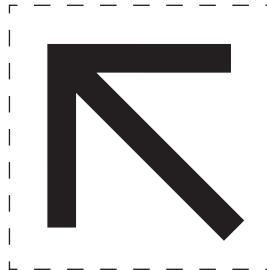
**Arrows**



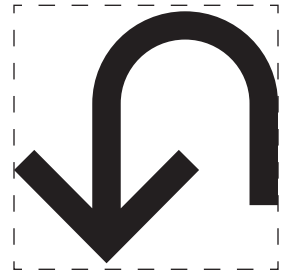
Up



Left



Up-left



U-turn

**Typefaces**

ABCDEFGHIJKLMNOPQR  
 STUVWXYZ 0123456789  
 abcdefghijklmnopqrstuvwxyz

Friends Regular

ABCDEFGHIJKLMNOPQR  
 STUVWXYZ 0123456789  
 abcdefghijklmnopqrstuvwxyz

Friends SemiBold



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 781 449 1351 / whitneyveigas.com

Program Colors and Arrows

date 1/29/2021

proj. no. WV18225

Balch Hall Renovation - Cornell University

scale



P0 - Grey (common spaces)



P1 - Red (Unit 1)



P2 - Plum (Unit 2)



P3 - Gold (Unit 3)



P4 - Blue (Unit 4)

Notes

Accent color varies (see message schedule) P0, P1, P2, P3 or P4



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Color Application

date 1/29/2021

proj. no. WV18225

Balch Hall Renovation - Cornell University

scale 3" = 1' - 0"

311





Notes

Typical mounting



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Sign Type 10

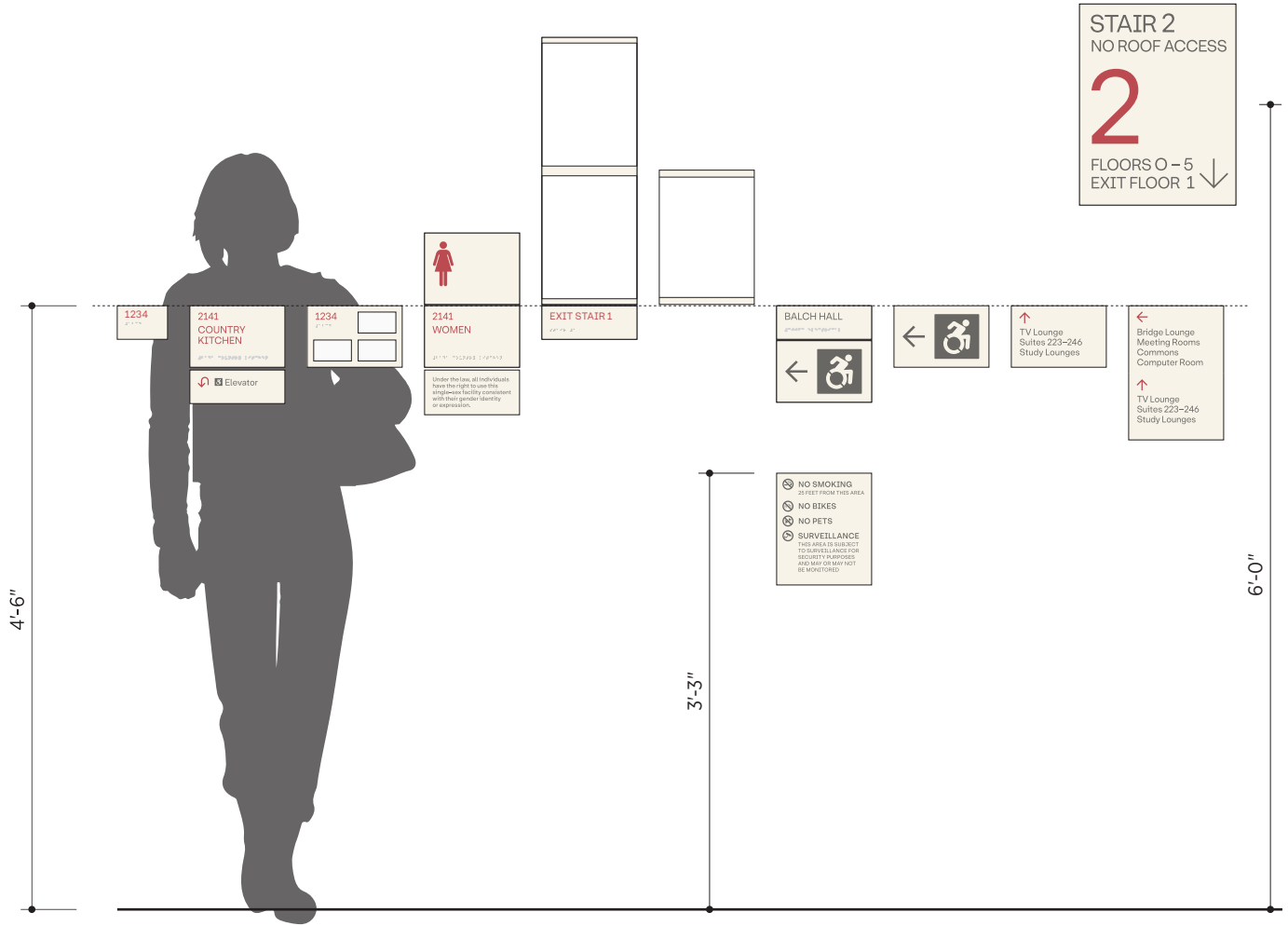
date 1/29/2021

proj. no. WV18225

Balch Hall Renovation - Cornell University

scale 3/4" = 1' - 0"

210



**Notes**

Typical mounting



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**Mounting Heights**

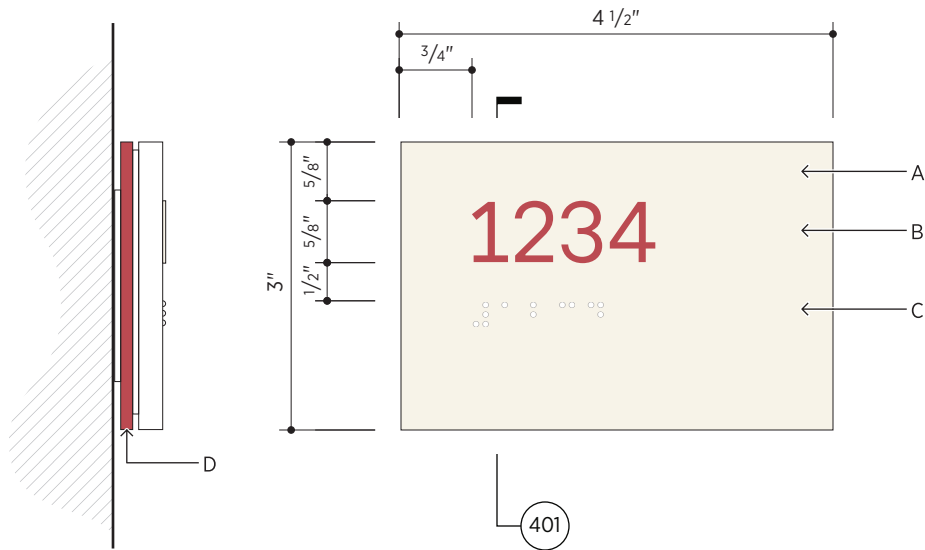
date 1/29/2021

proj. no. WV18225

Balch Hall Renovation - Cornell University

scale 3/4" = 1' - 0"

210



Notes

- A Clear thermoformed acrylic plaque, second surface painted P5
- B Raised text, color varies (see message schedule) P0, P1, P2, P3 or P4
- C Grade 2 Braille, left clear
- D Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4



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Sign Type 10  
Residential Unit ID

date 1/29/2021

proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

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Notes

- A Clear thermoformed acrylic plaque, second surface painted P5
- B Raised text, color varies (see message schedule) P0, P1, P2, P3 or P4
- C Grade 2 Braille, left clear
- D Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4



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Sign Type 11  
Primary Room ID

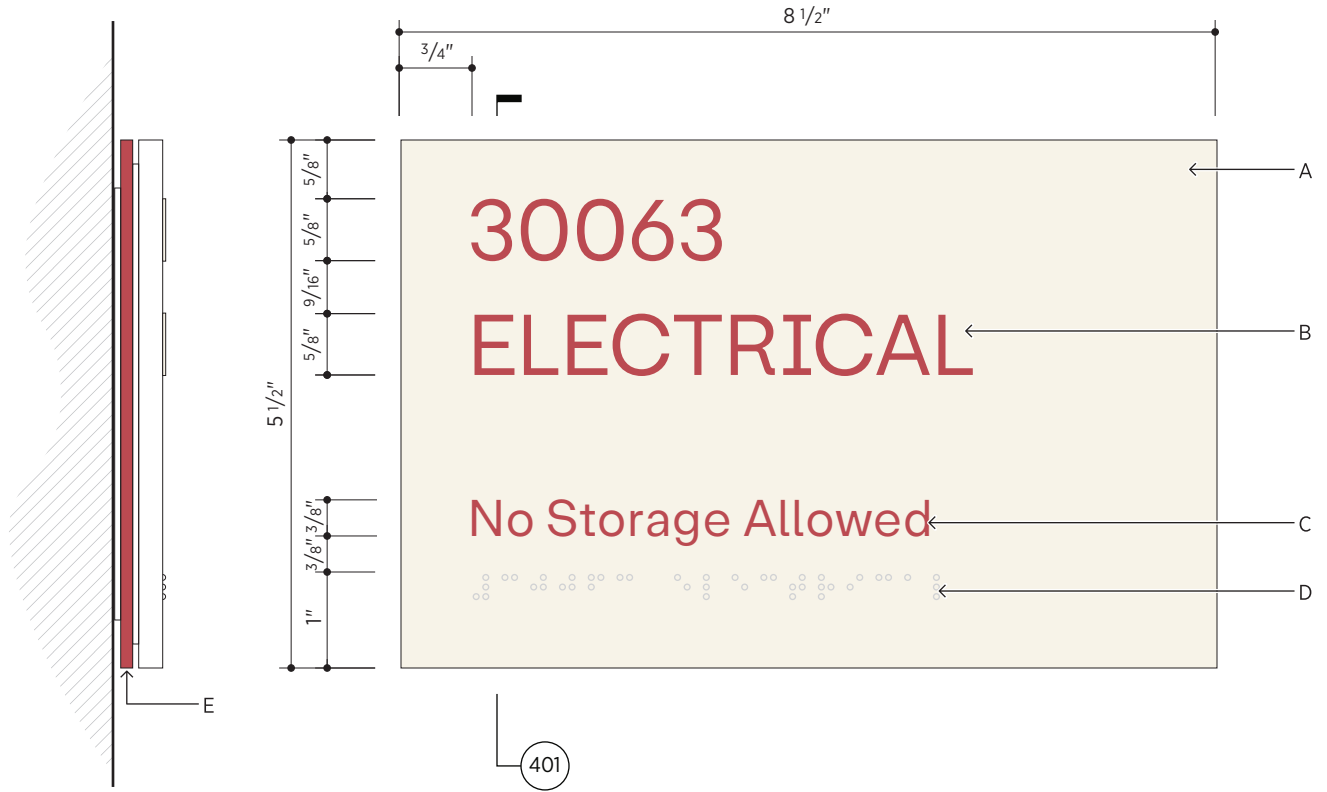
date 1/29/2021

proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

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Notes

- A Clear thermoformed acrylic plaque, second surface painted P5
- B Raised text, color varies (see message schedule) P0, P1, P2, P3 or P4
- C Secondary text (where occurs), digitally printed, color varies (see message schedule) P0, P1, P2, P3 or P4
- D Grade 2 Braille, left clear
- D Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4



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Sign Type 12  
Utility Room ID

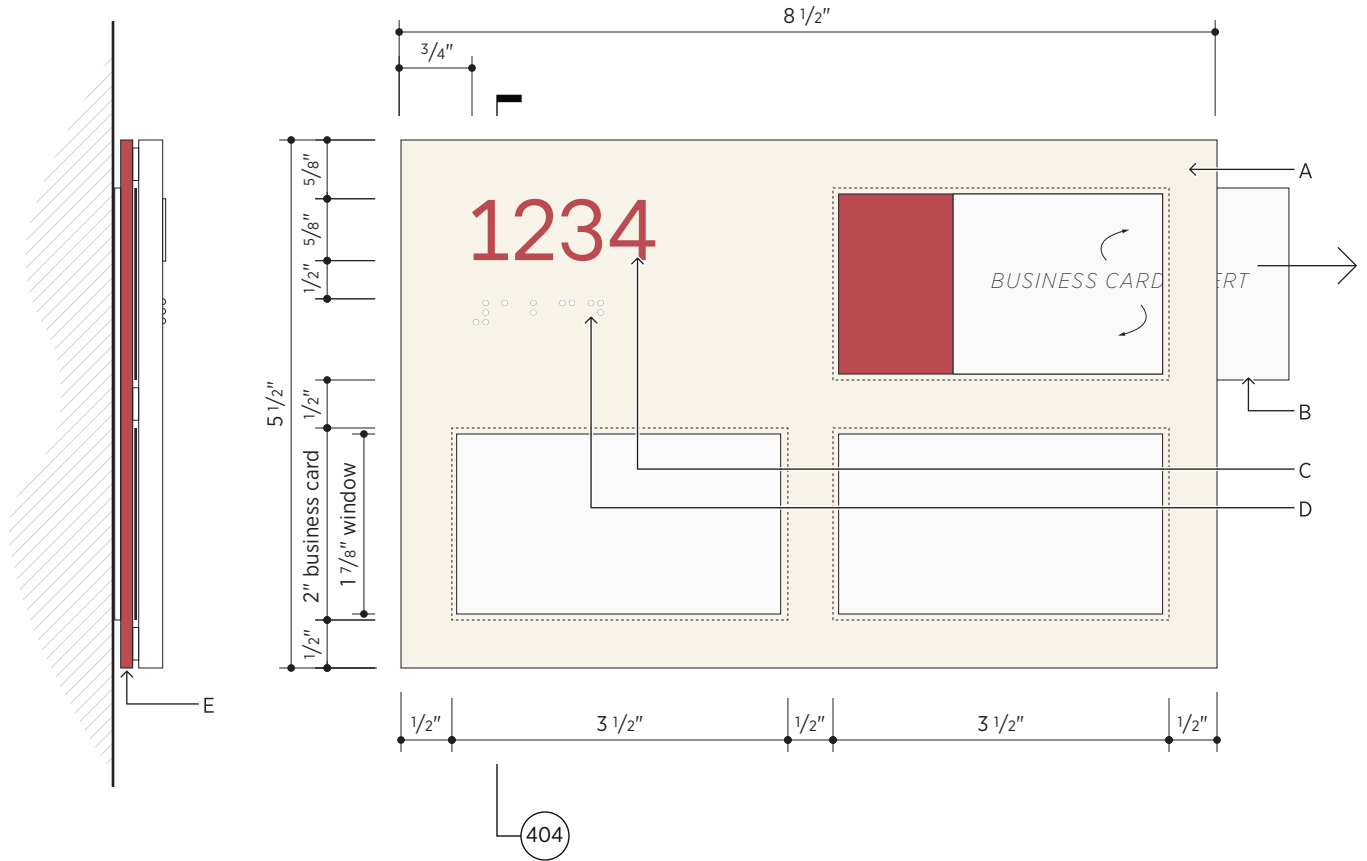
date 1/29/2021

proj. no. WV18225

scale 1:2

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312



**Notes**

- A Clear thermoformed acrylic plaque, second surface painted P5, with windows masked and left clear
- B Business card insert (by others)
- C Raised text, color varies (see message schedule) P0, P1, P2, P3 or P4
- D Grade 2 Braille, left clear
- E Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4



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 781 449 1351 / whitneyveigas.com

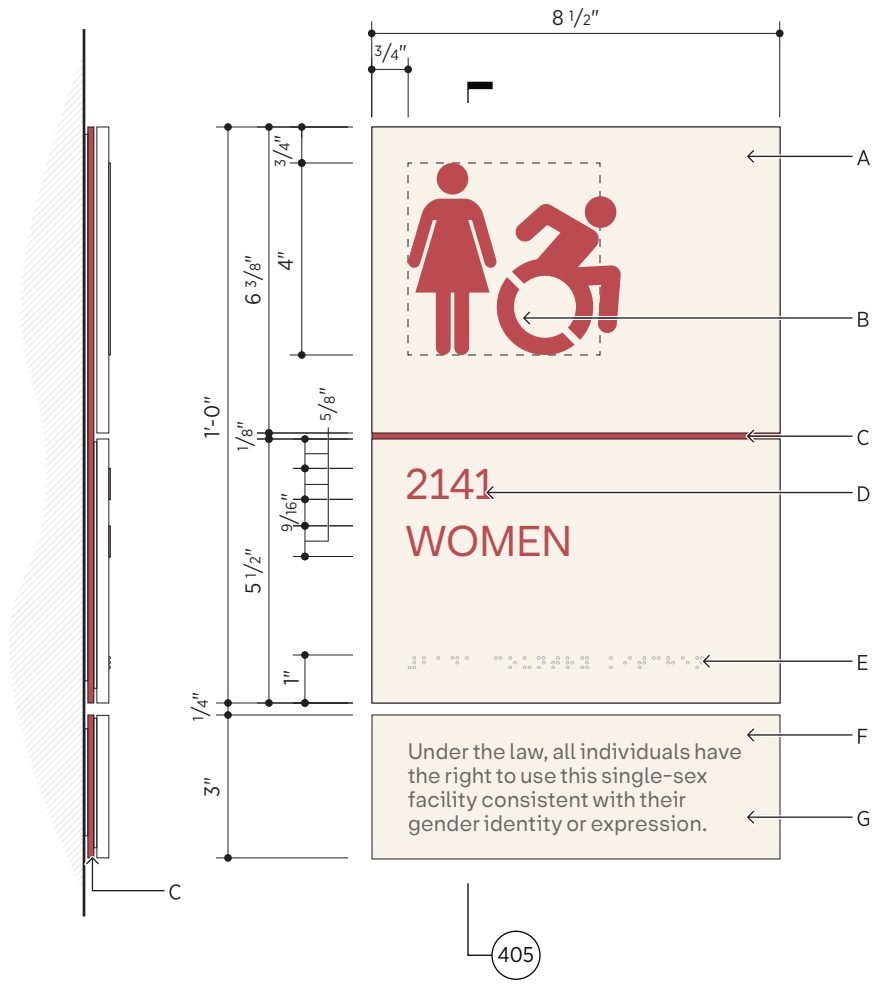
Sign Type 13  
 Office ID

date 1/29/2021

proj. no. WV18225

scale 1:2

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405

**Notes**

- A Clear thermoformed acrylic plaque, second surface painted P5
- B Raised symbol, color varies (see message schedule) P0, P1, P2, P3 or P4
- C Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4
- D Raised text, color varies (see message schedule) P0, P1, P2, P3 or P4
- E Grade 2 Braille, left clear
- F Secondary plaque, mounted separately: clear acrylic, second surface painted P5
- G Digitally printed text, P0



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**Sign Type 14**  
**Restroom ID**

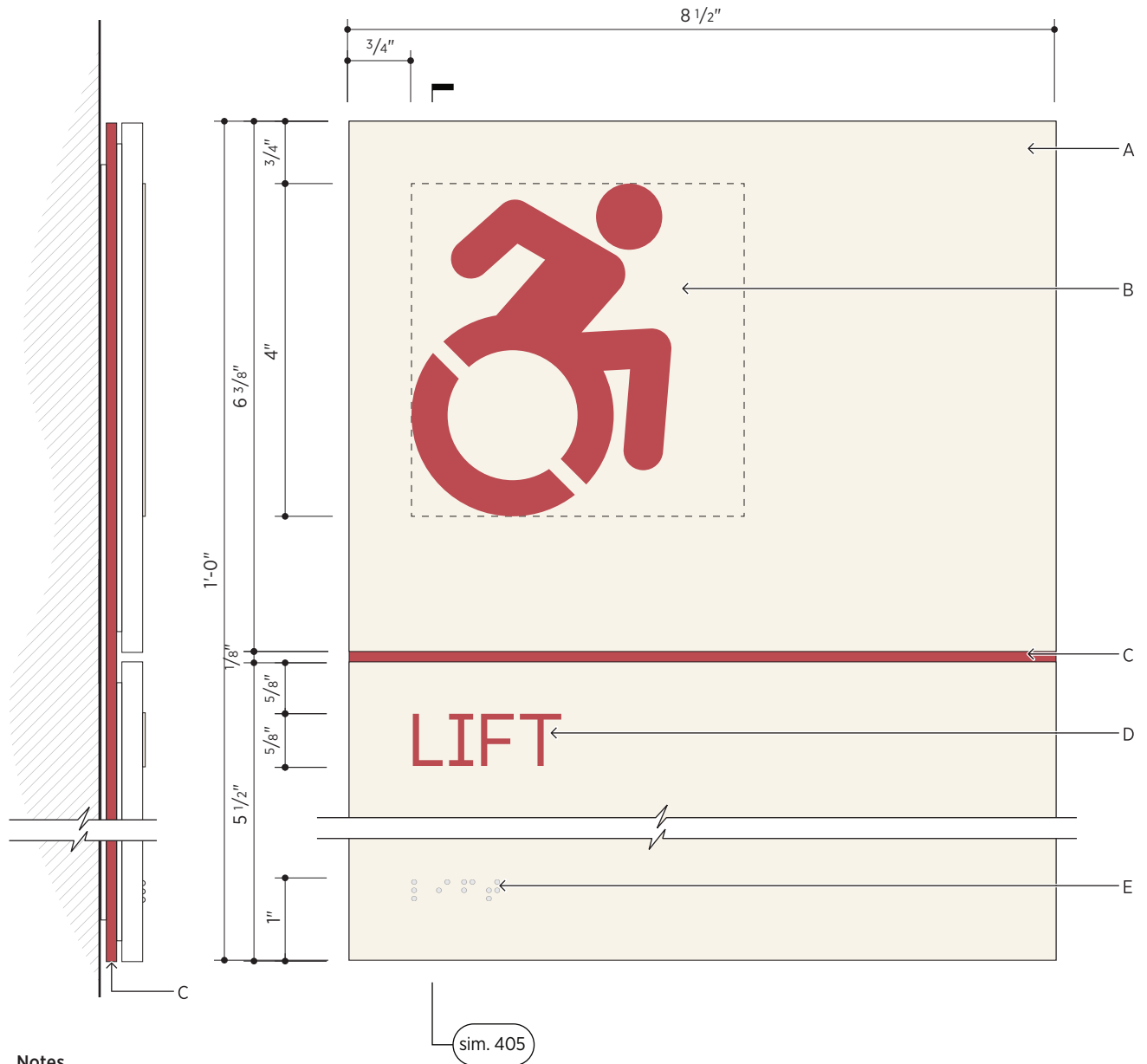
date 1/29/2021

proj. no. WV18225

Balch Hall Renovation - Cornell University

scale 3" = 1' - 0"

314



**Notes**

- A Clear thermoformed acrylic plaque, second surface painted P5
- B Raised symbol, color varies (see message schedule) P0, P1, P2, P3 or P4
- C Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4
- D Raised text, color varies (see message schedule) P0, P1, P2, P3 or P4
- E Grade 2 Braille, left clear



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**Sign Type 14**  
**Restroom ID**

date 1/29/2021

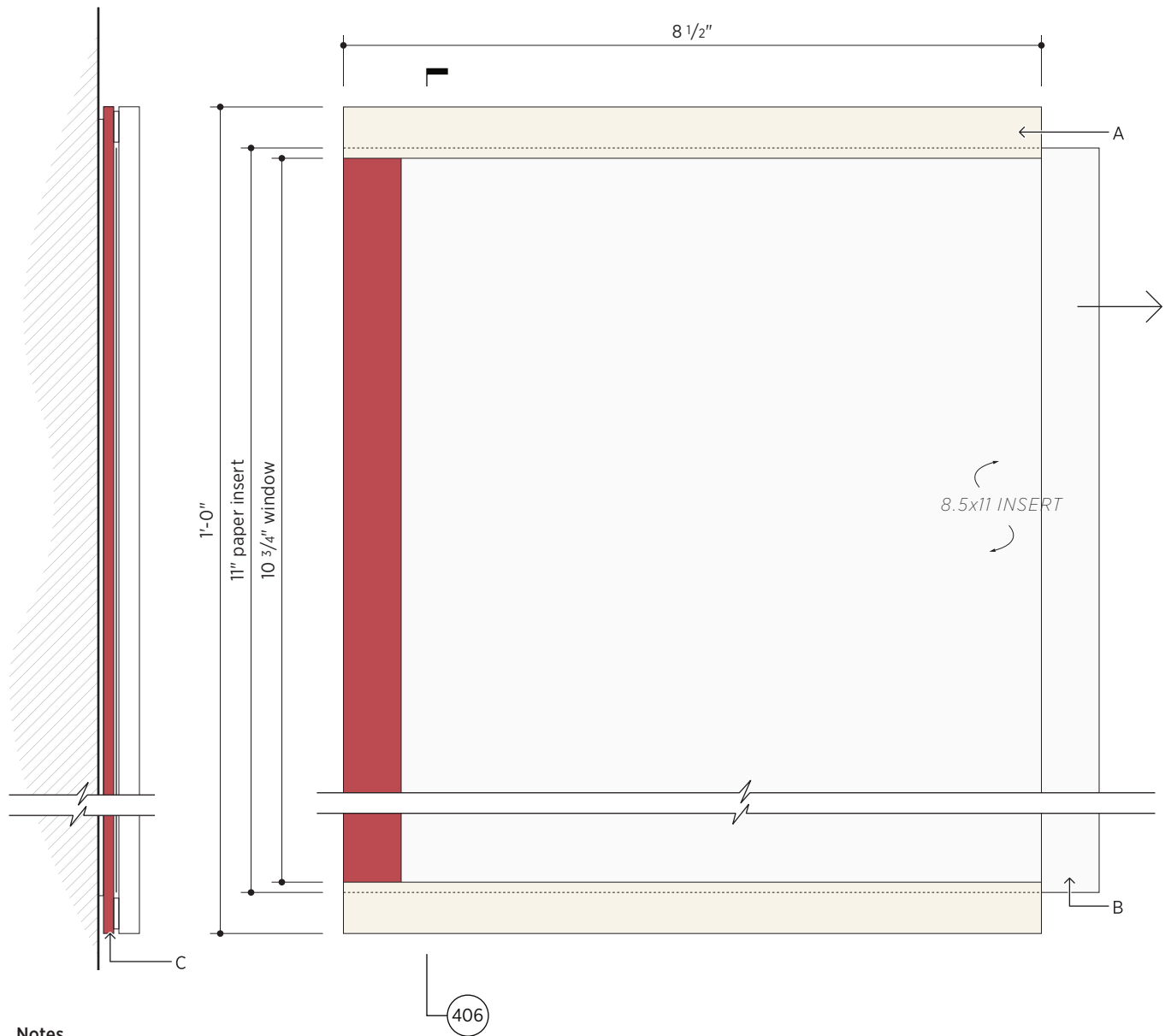
proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

314A





**Notes**

- A Clear acrylic plaque, second surface painted P5, with window masked and left clear
- B 8.5x11 insert (by others)
- C Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4



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**Sign Type 15**  
**Paper Insert Plaques**

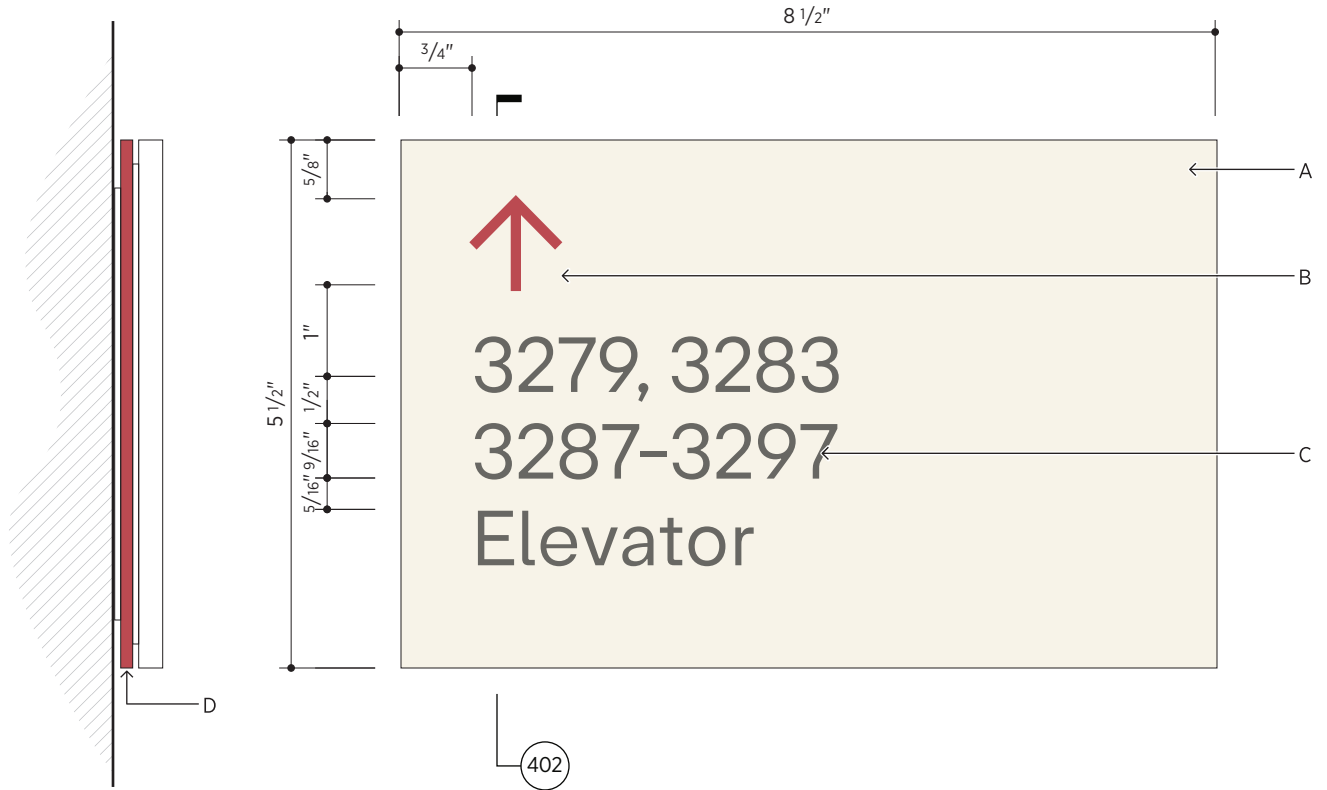
date 1/29/2021

proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

315



Notes

- A Clear acrylic plaque, second surface painted P5
- B Digitally printed arrow, color varies (see message schedule) P0, P1, P2, P3 or P4
- C Digitally printed text and symbols, P0
- D Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4



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Sign Type 16A  
Directional/Wayfinding (short)

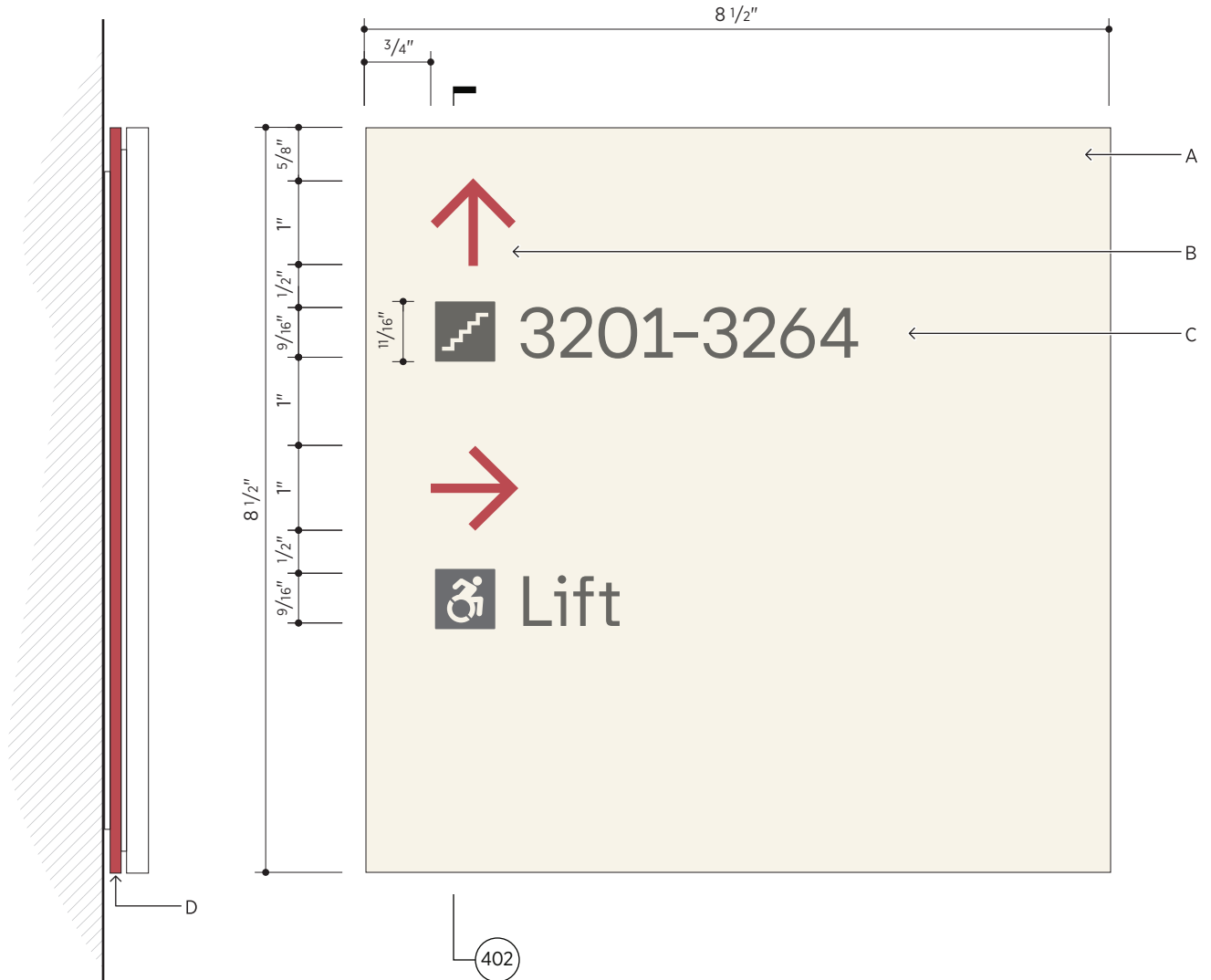
date 1/29/2021

proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

316A



**Notes**

- A Clear acrylic plaque, second surface painted P5
- B Digitally printed arrow, color varies (see message schedule) P0, P1, P2, P3 or P4
- C Digitally printed text and symbols, P0
- D Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4



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Sign Type 16B  
 Directional/Wayfinding (med)

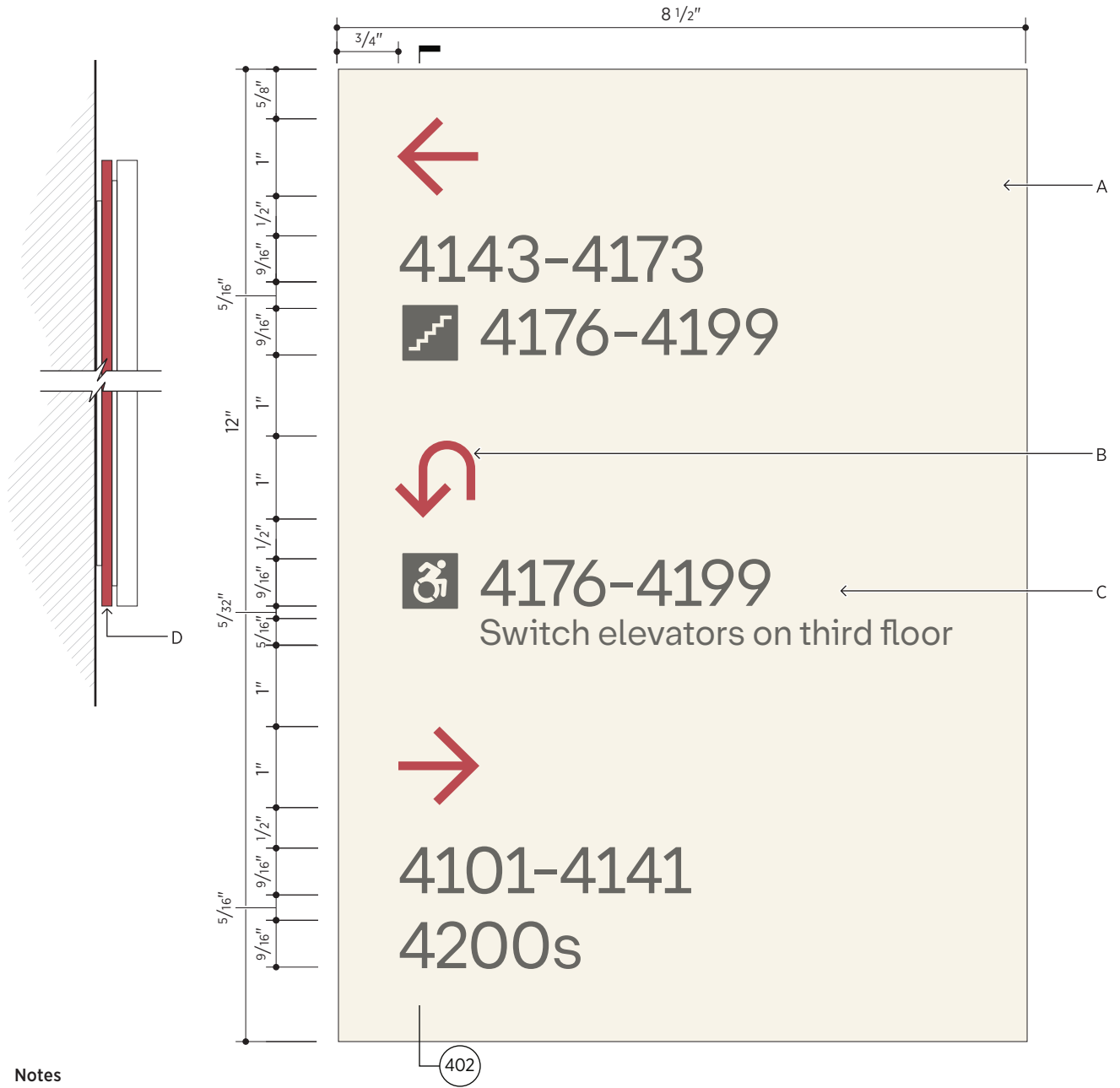
date 1/29/2021

proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

316B



**Notes**

- A Clear acrylic plaque, second surface painted P5
- B Digitally printed arrow, color varies (see message schedule) P0, P1, P2, P3 or P4
- C Digitally printed text and symbols, P0
- D Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4



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 781 449 1351 / whitneyveigas.com

Sign Type 16C  
 Directional/Wayfinding (long)

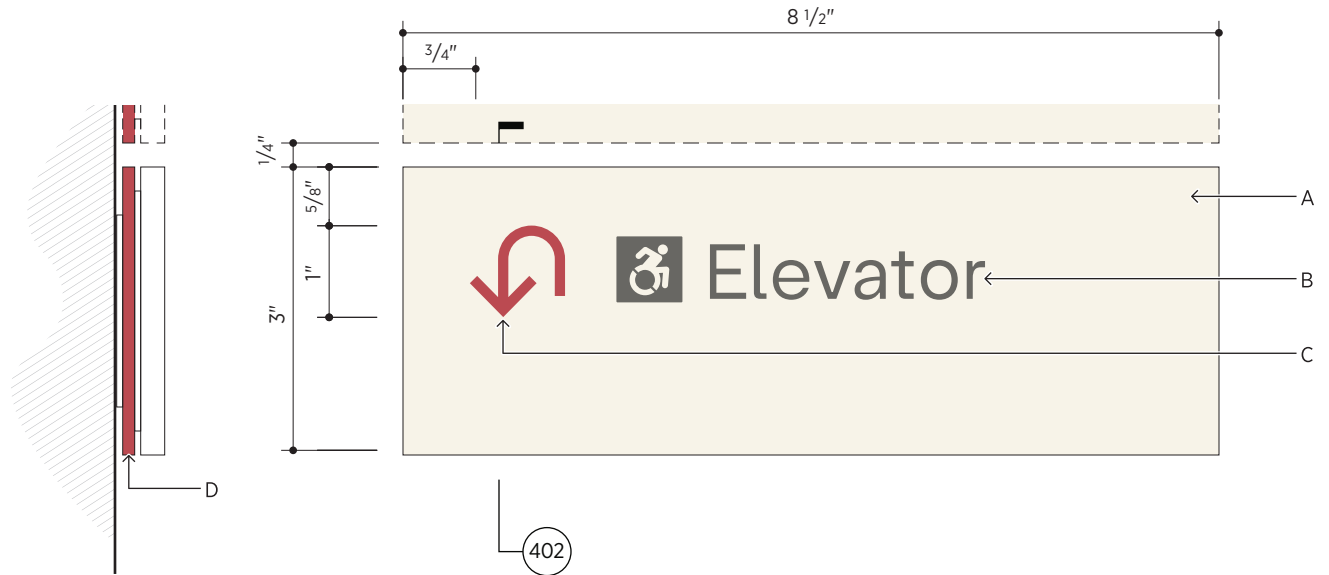
date 1/29/2021

proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

316C



Notes

- A Clear acrylic plaque, second surface painted P5, mounts beneath Room ID
- B Digitally printed text and symbols, P0
- C Digitally printed arrow, color varies (see message schedule) P0, P1, P2, P3 or P4
- D Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4



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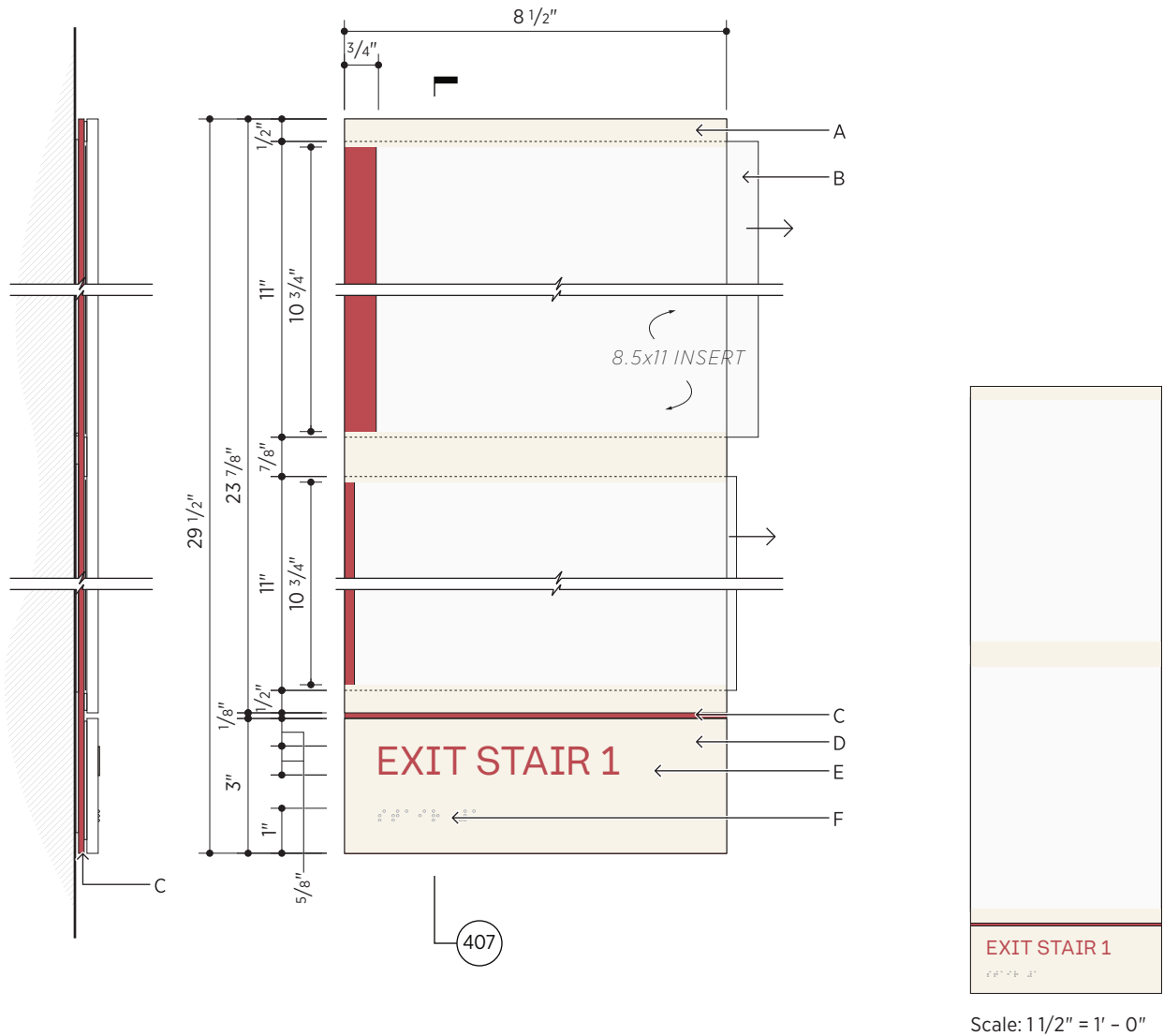
Sign Type 16D  
Directional/Wayfinding  
(supplemental)  
Balch Hall Renovation - Cornell University

date 1/29/2021

proj. no. WV18225

scale 1:2

316D



Scale: 1 1/2" = 1' - 0"

**Notes**

- A Clear acrylic plaque, second surface painted P5, with window masked and left clear
- B 8.5x11 insert (by others)
- C Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4
- D Clear thermoformed acrylic plaque, second surface painted P5
- E Raised text, color varies (see message schedule) P0, P1, P2, P3 or P4
- F Grade 2 Braille, left clear



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Sign Type 17  
 Stair ID (egress)

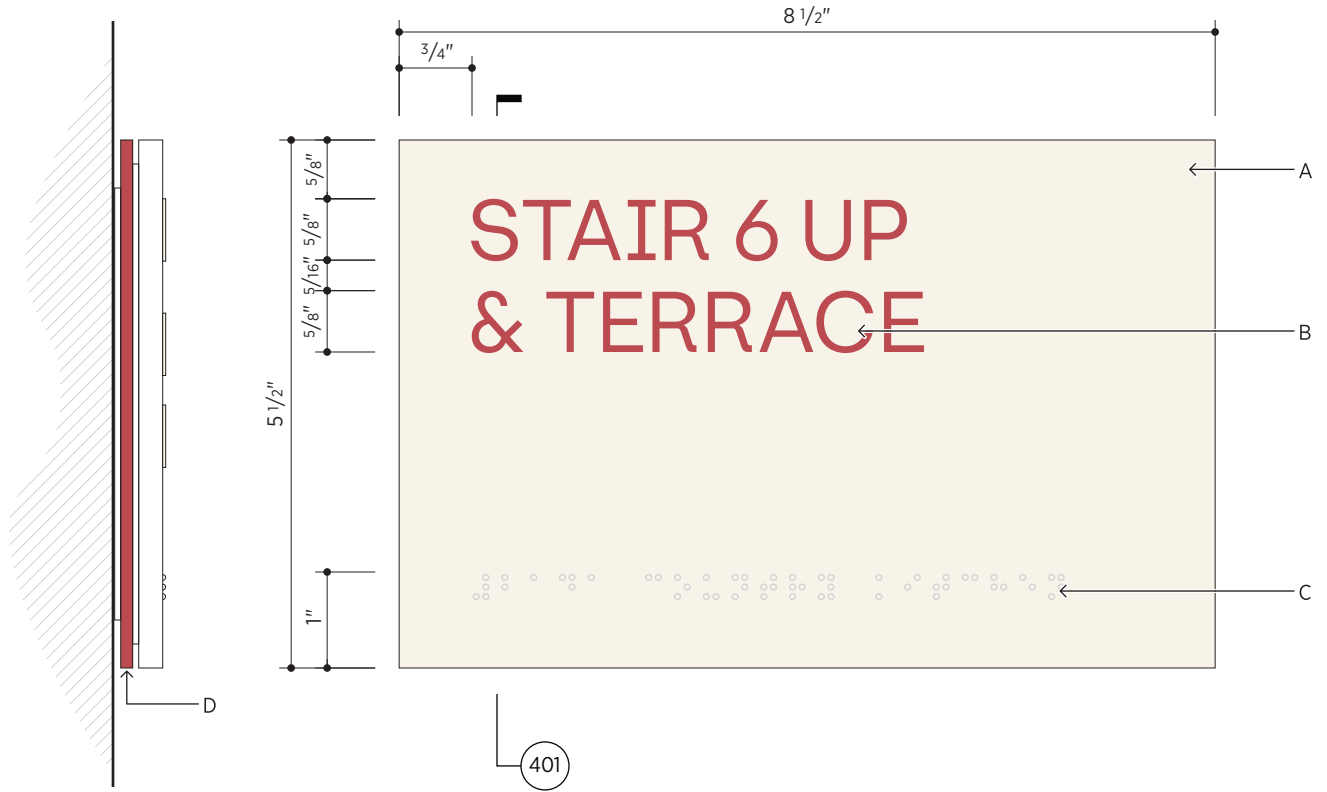
date 1/29/2021

proj. no. WV18225

scale 3" = 1' - 0"

Balch Hall Renovation - Cornell University

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**Notes**

- A Clear thermoformed acrylic plaque, second surface painted P5
- B Raised text, color varies (see message schedule) P0, P1, P2, P3 or P4
- C Grade 2 Braille, left clear
- D Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4



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Sign Type 17A  
 Stair ID (convenience)

date 1/29/2021

proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

317A



Notes

- A Clear thermoformed acrylic plaque, second surface painted P5
- B Raised text, color varies (see message schedule) P0, P1, P2, P3 or P4
- C Grade 2 Braille, left clear
- D Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4



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Sign Type 18  
Stair Level ID

date 1/29/2021

proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

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**Notes**

- A Aluminum plaque, first surface painted P5 on all sides
- B Digitally printed text, P0
- C Digitally printed floor number, color varies (see message schedule) P0, P1, P2, P3 or P4



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Sign Type 19  
 Stair Landing

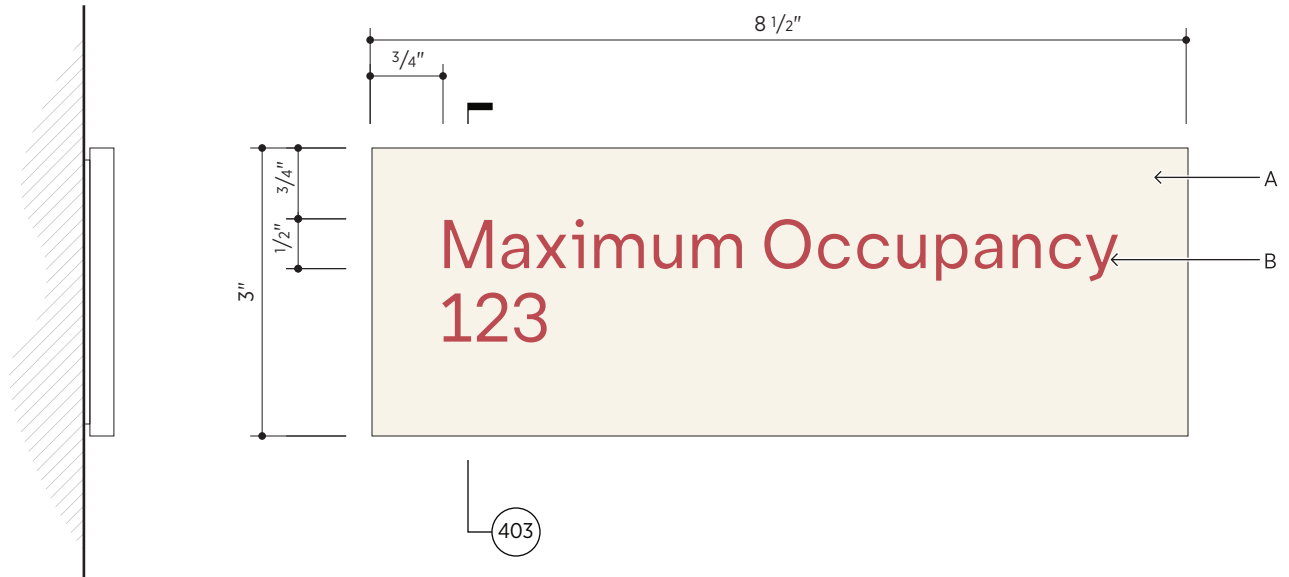
date 1/29/2021

proj. no. WV18225

scale 3" = 1' - 0"

Balch Hall Renovation - Cornell University

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Notes

- A Clear acrylic plaque, second surface painted P5
- B Digitally printed text, color varies (see message schedule) P0, P1, P2, P3 or P4

2020 BCNYS 1004.9



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Sign Type 21  
Occupancy

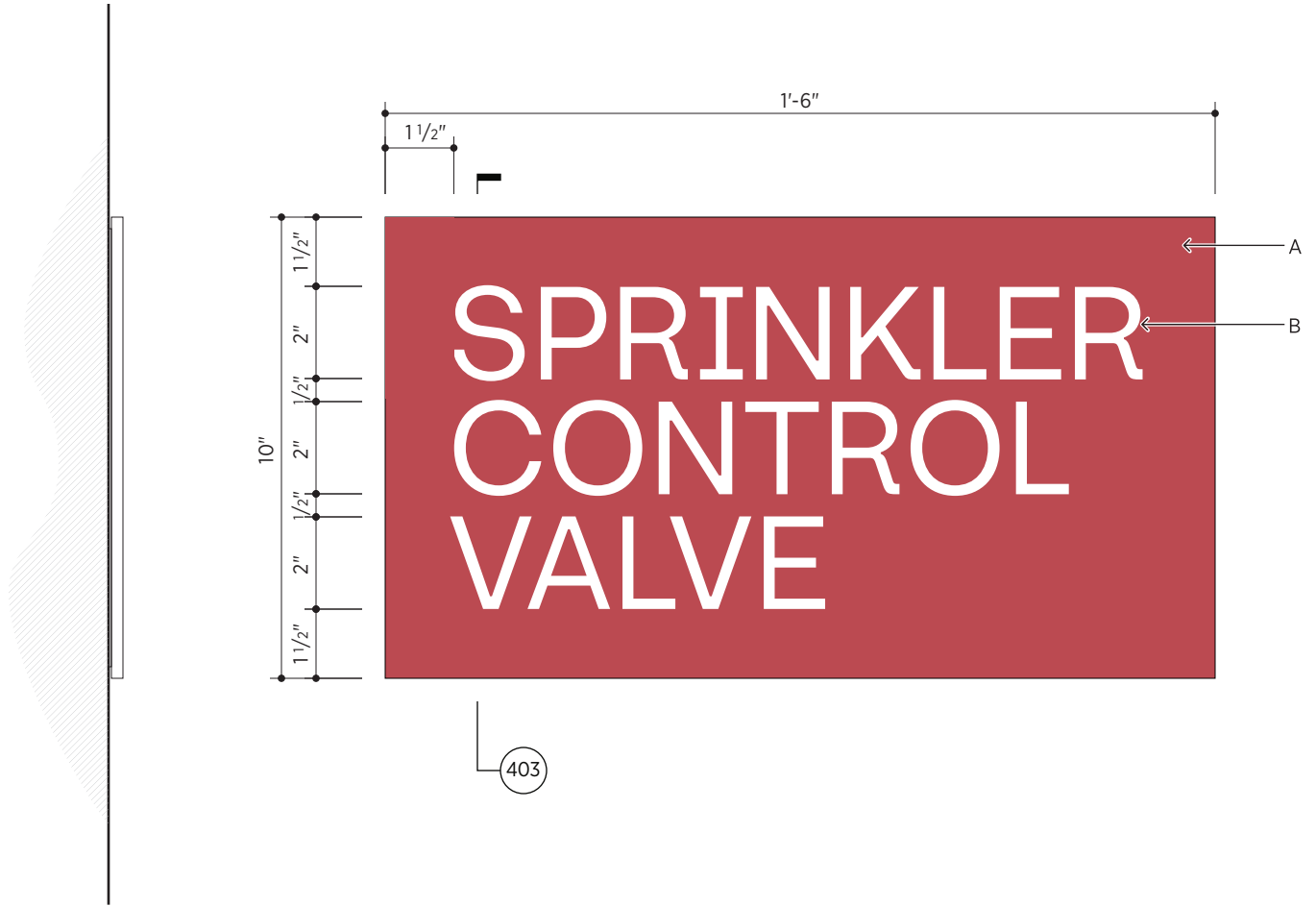
date 1/29/2021

proj. no. WV18225

scale 1:2

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Notes

- A Clear acrylic plaque, second surface painted P1
- B Digitally printed text, white



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Sign Type 23  
Interior Fire Regulatory

date 1/29/2021

proj. no. WV18225

Balch Hall Renovation - Cornell University

scale 3" = 1' - 0"

323



Notes

- A Clear acrylic plaque, second surface painted P5
- B Digitally printed text, color varies (see message schedule) P0, P1, P2, P3 or P4
- C Digitally printed text, P0



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Sign Type 24  
2-Way Communication Device

date 1/29/2021

proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

324



Notes

- A Clear acrylic plaque, second surface painted P5
- B Digitally printed text and graphics, P0
- C Backer panel, painted P0



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Sign Type 25  
Entry Signage

date 1/29/2021

proj. no. WV18225

scale 1:2

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325



Notes

A White cut vinyl, applied to first surface of glass



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Sign Type 25  
Entry Signage ALTERNATE

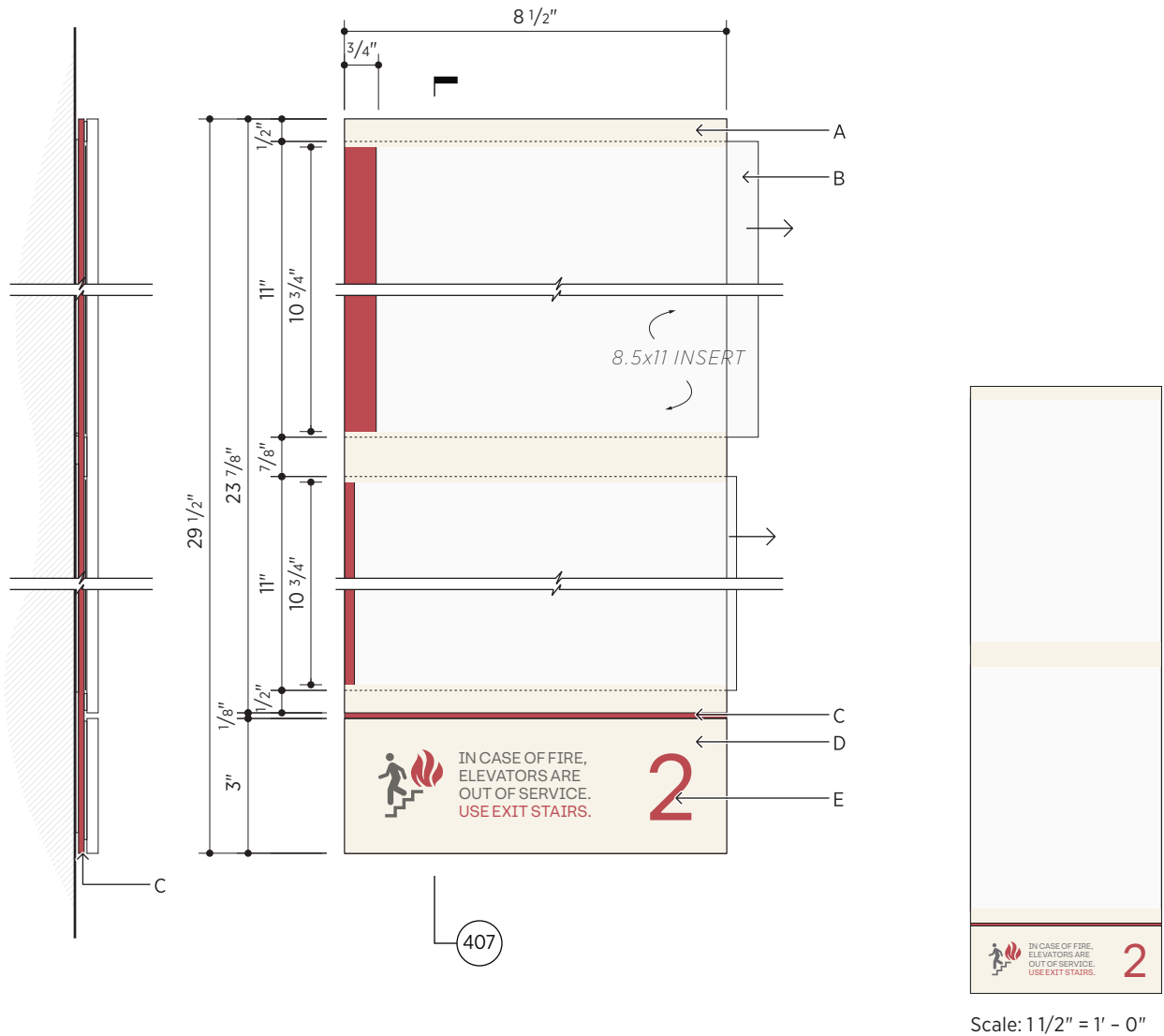
date 1/29/2021

proj. no. WV18225

scale 1:2

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325.1



**Notes**

- A Clear acrylic plaque, second surface painted P5, with window masked and left clear
  - B 8.5x11 insert (by others)
  - C Backer panel, color varies (see message schedule) P0, P1, P2, P3 or P4
  - D Clear acrylic plaque, second surface painted P5
  - E Digitally printed text and symbol, P0 and P1
- 2020 BCNYS 3002.3



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 781 449 1351 / whitneyveigas.com

**Sign Type 30**  
**Elevator Egress Maps**

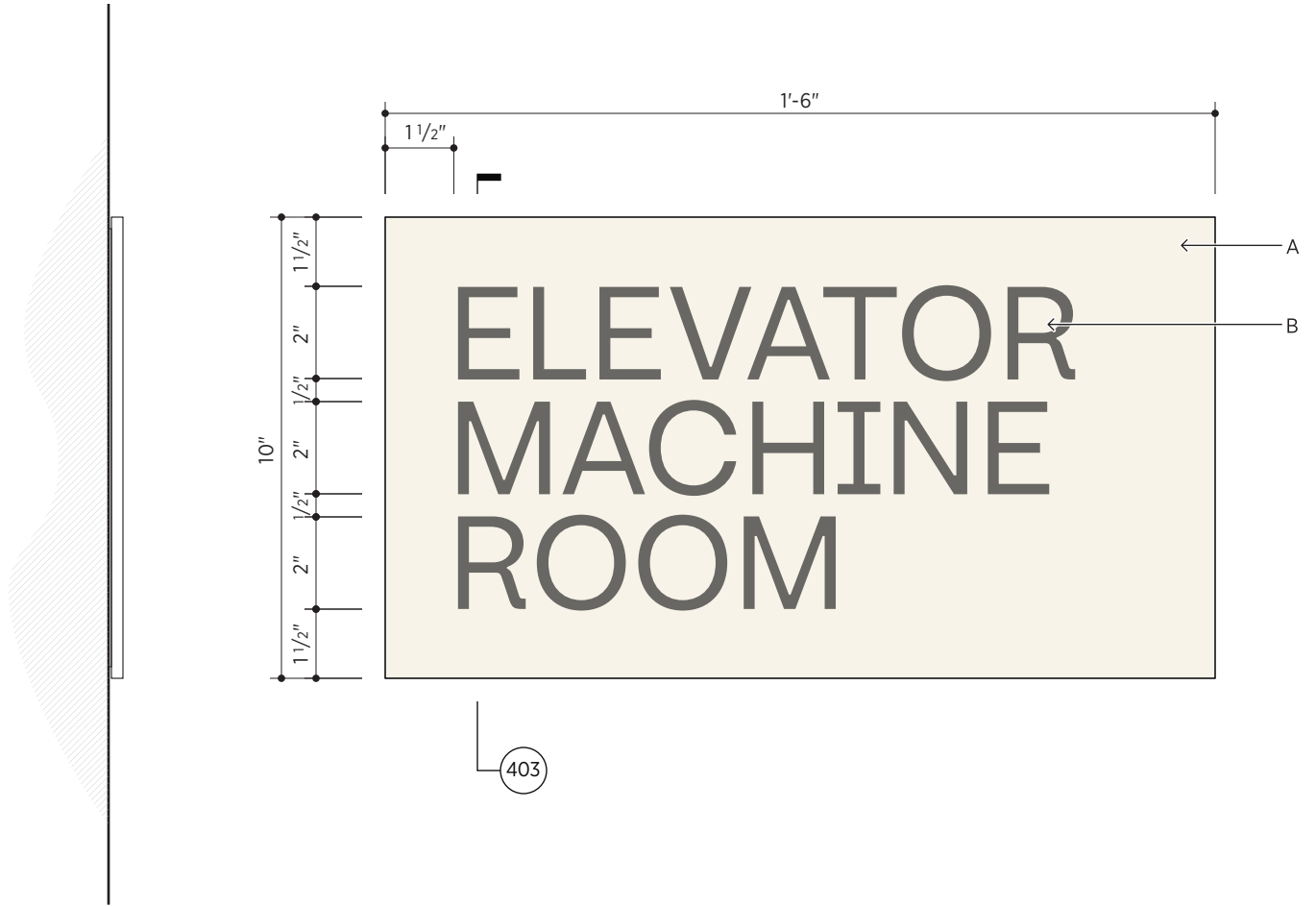
date 1/29/2021

proj. no. WV18225

Balch Hall Renovation - Cornell University

scale 3" = 1' - 0"

330



Notes

- A Clear acrylic plaque, second surface painted P5
- B Digitally printed text and graphics, P0



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Sign Type 31  
Elevator Regulatory

date 1/29/2021

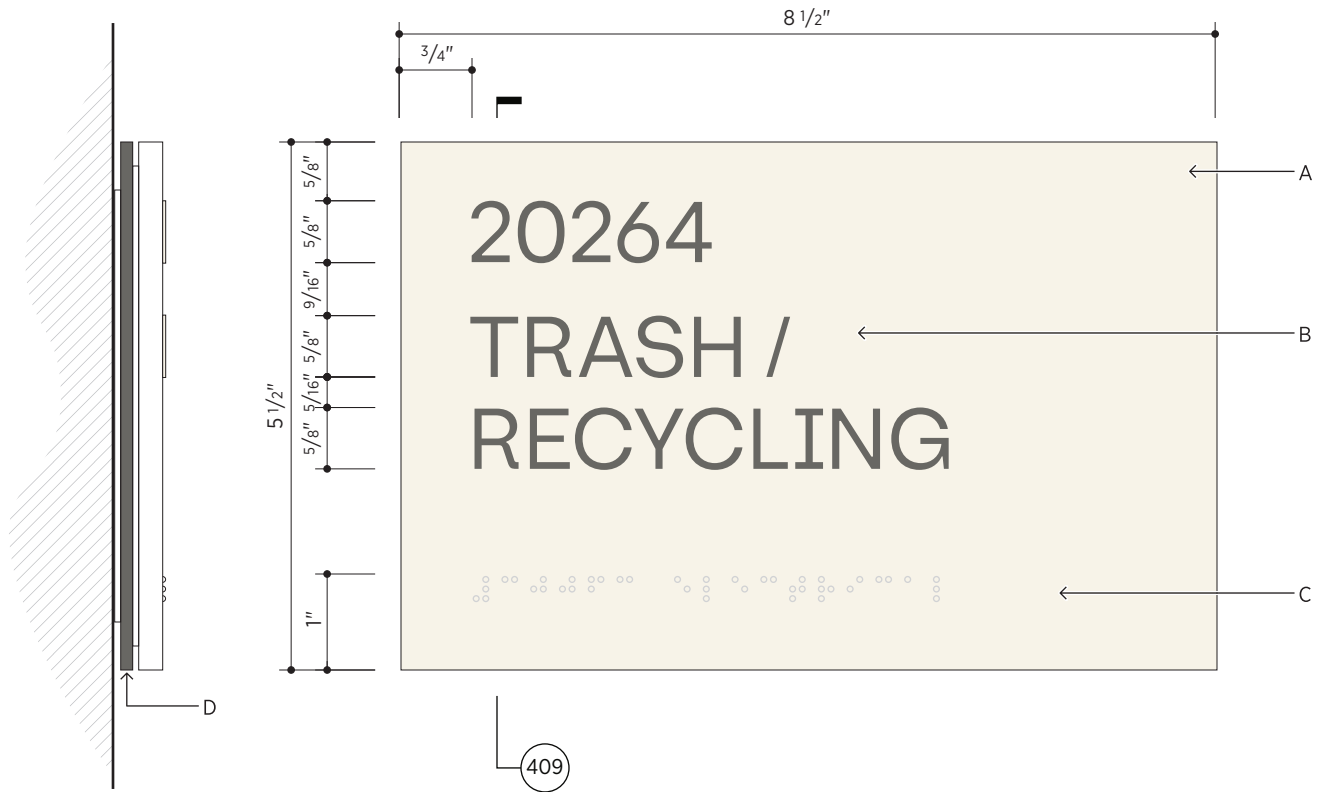
proj. no. WV18225

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scale 3" = 1' - 0"

331





Notes

- A Clear thermoformed acrylic plaque, second surface painted P5
- B Raised text, P0
- C Grade 2 Braille, left clear
- D Backer panel, painted P0



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Sign Type 50  
Exterior Door ID

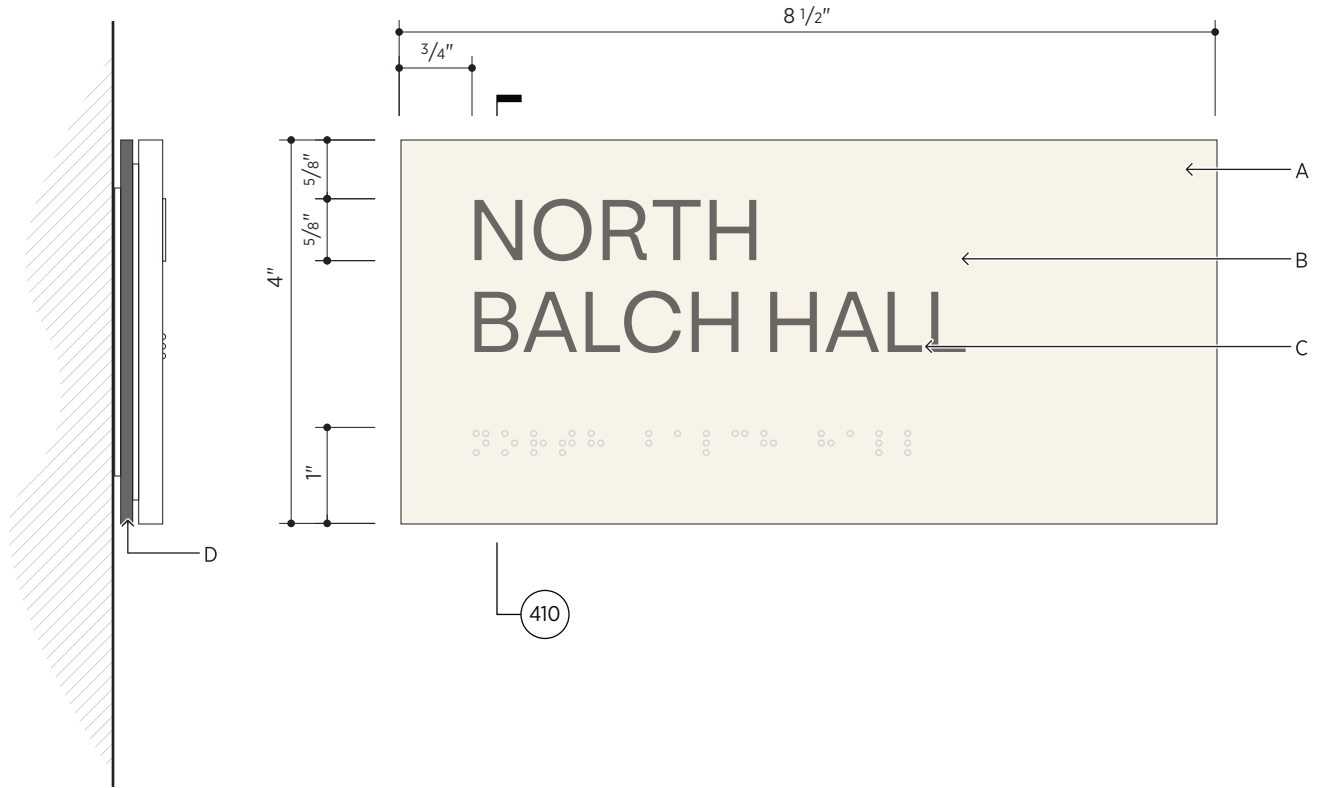
date 1/29/2021

proj. no. WV18225

scale 1:2

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350



Notes

- A Clear thermoformed acrylic plaque, second surface painted P5
- B Raised text, PO
- C Grade 2 Braille, left clear
- D Backer panel, PO



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Sign Type 51  
Exterior Building ID

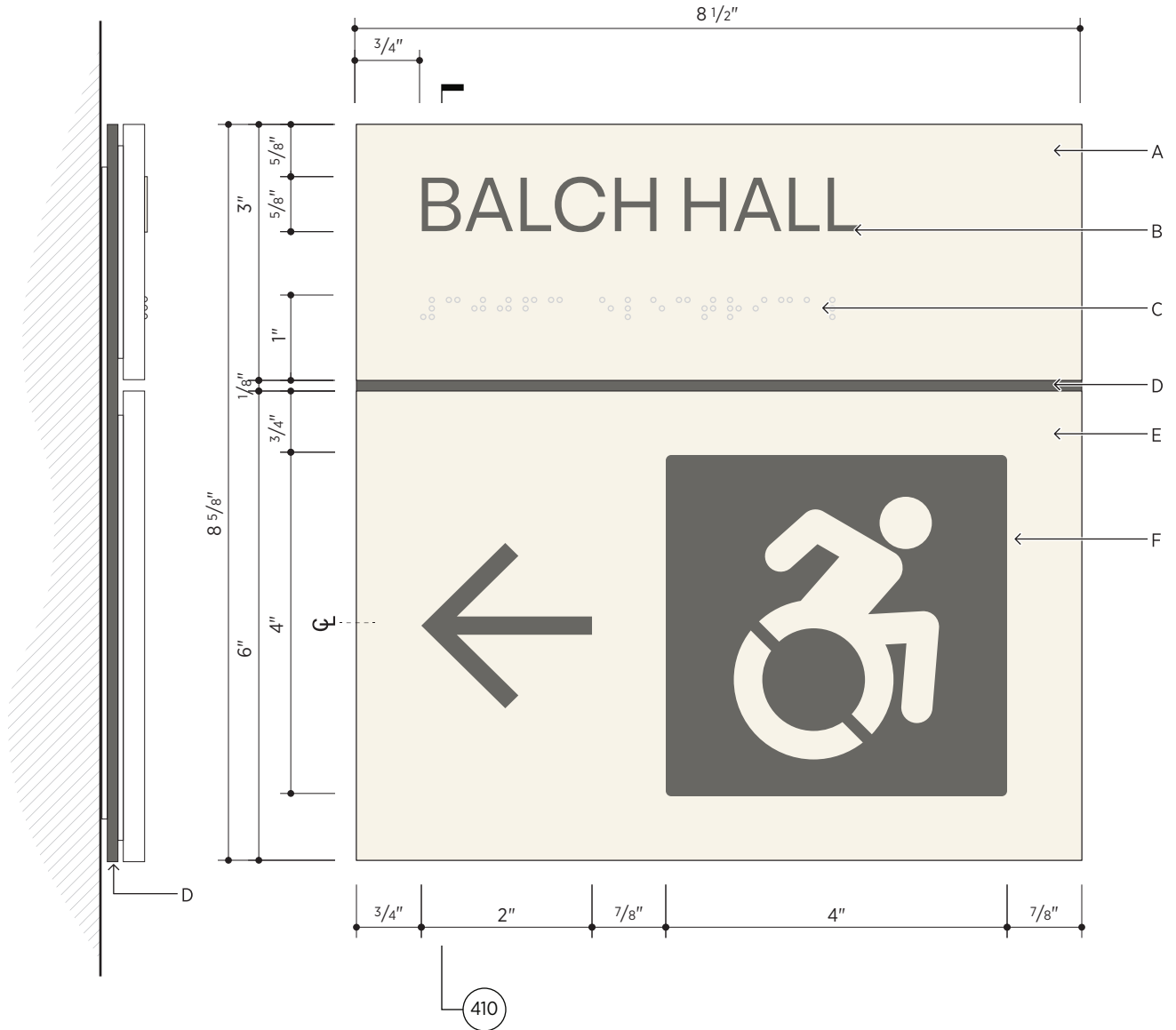
date 1/29/2021

proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

351



**Notes**

- A Clear thermoformed acrylic plaque, second surface painted P5
- B Raised text, PO
- C Grade 2 Braille, left clear
- D Backer panel, PO
- E Clear acrylic plaque, second surface painted P5
- F Accessible symbol and arrow digitally printed P0



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

Sign Type 52  
 Ext Building ID / Accessibility

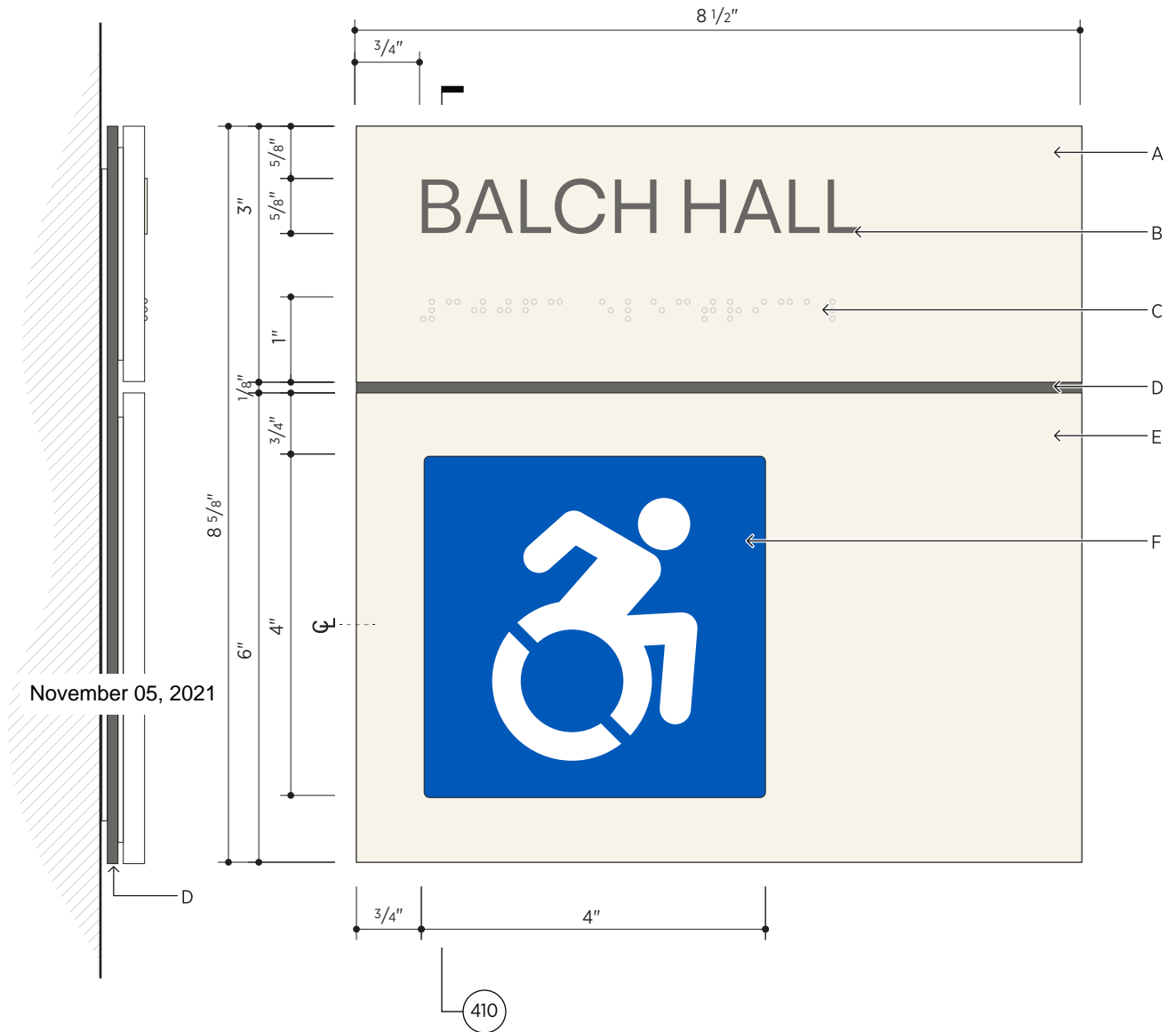
date 1/29/2021

proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

352



**Notes**

- A Clear thermoformed acrylic plaque, second surface painted P5
- B Raised text, PO
- C Grade 2 Braille, left clear
- D Backer panel, PO
- E Clear acrylic plaque, second surface painted P5
- F Blue accessible symbol digitally printed P7



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

Sign Type 52  
 Ext Building ID / Accessibility

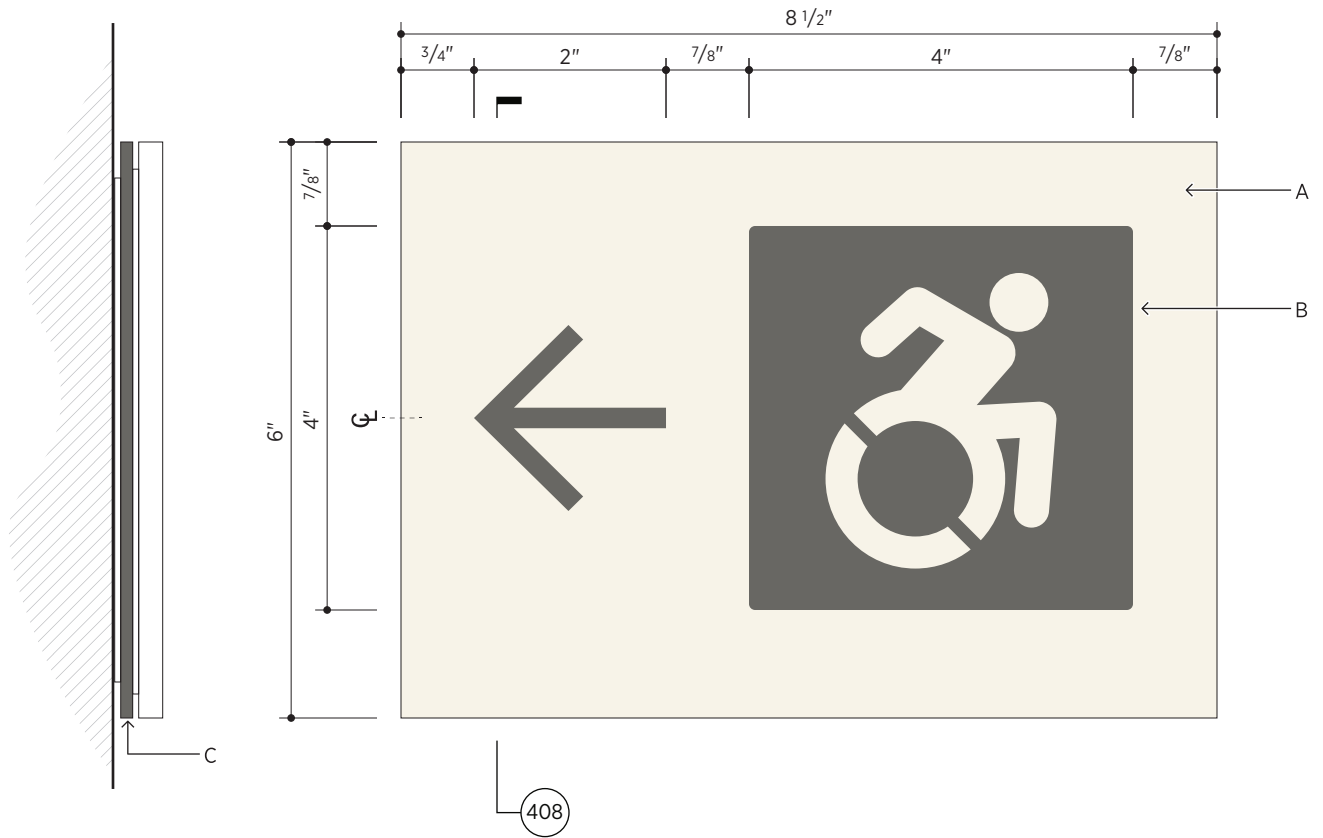
date 1/29/2021

proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

352.1



**Notes**

- A Clear acrylic plaque, second surface painted P5
- B Accessible symbol and arrow digitally printed PO
- C Backer panel, PO



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

**Sign Type 53**  
**Ext Accessibility Directional**

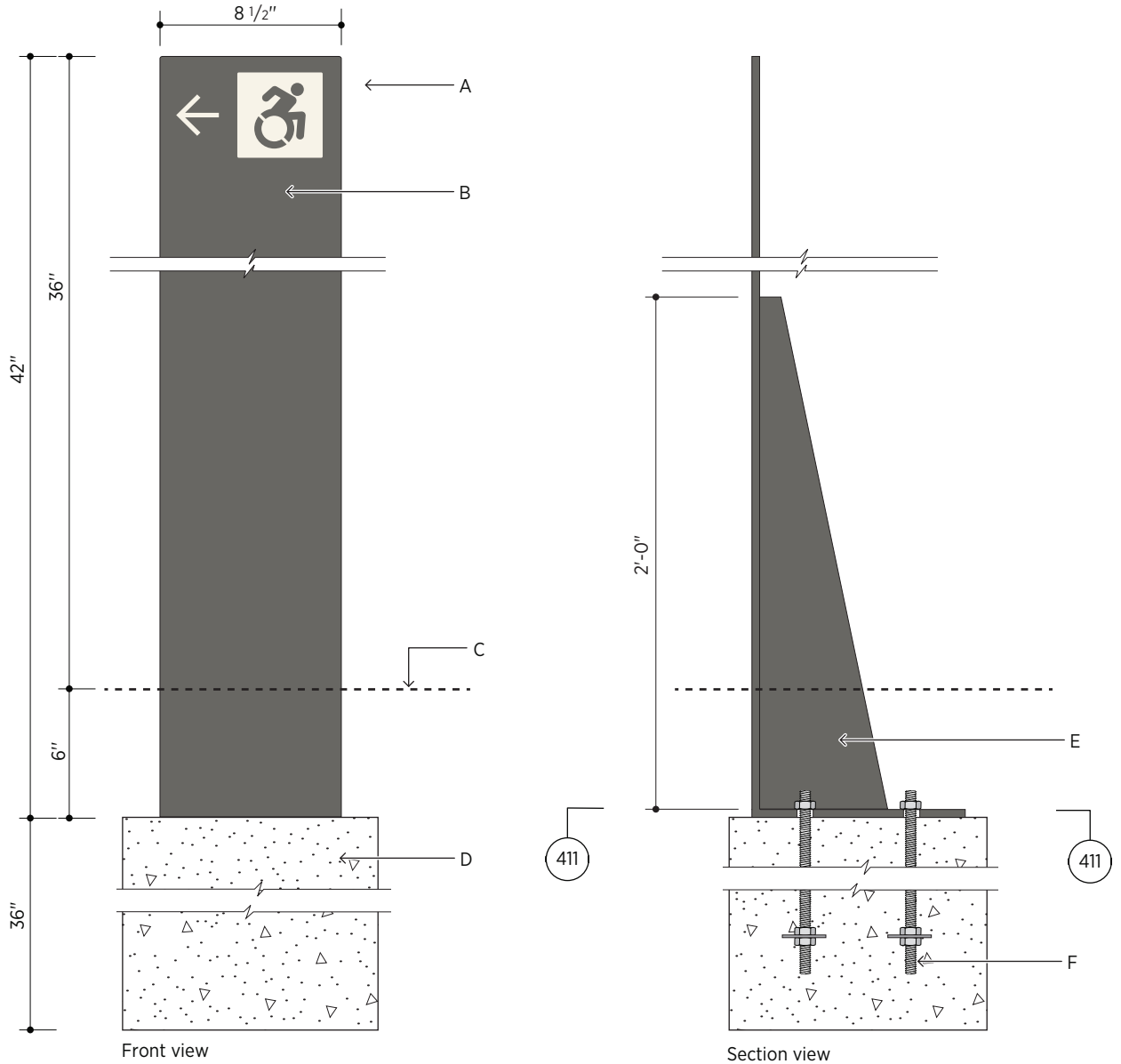
date 1/29/2021

proj. no. WV18225

scale 3" = 1' - 0"

Balch Hall Renovation - Cornell University

353



**Notes**

- A 1/4" thick steel plate with eased edges, painted P0
- B Cut vinyl, P5
- C Grade
- D Concrete footing, with 12" dia. x 36" deep sonotube
- E 5" x 5" x 1/4" thick steel gusset welded to steel plate, painted P0
- F 1/2" diameter threaded rod, 20" long, with 3" diameter washer and nuts



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

**Sign Type 54**  
**Ext Accessibility Directional,**  
**Freestanding**  
 Balch Hall Renovation - Cornell University

date 1/29/2021

proj. no. WV18225

scale 1 1/2"=1'-0"



Notes

- A Aluminum plaque, surface painted P1
- B Applied vinyl text, white



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
781 449 1351 / whitneyveigas.com

Sign Type 60  
Exterior Fire Regulatory

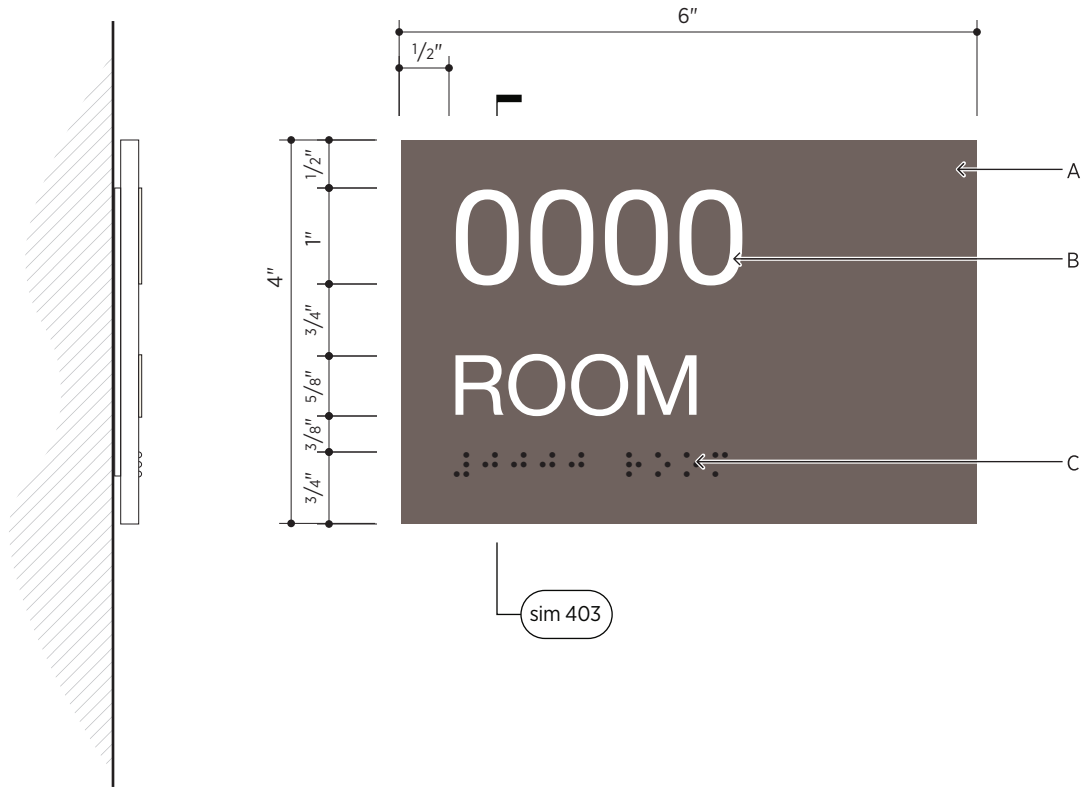
date 1/29/2021

proj. no. WV18225

scale 3" = 1' - 0"

Balch Hall Renovation - Cornell University

360



Notes

Design is to match existing Tatkon signage, with layout modified for ADA compliance

A Clear thermoformed acrylic plaque, second surface painted **to match existing**

B Raised text, white

C Grade 2 Braille, left clear



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
781 449 1351 / whitneyveigas.com

Sign Type 99  
Tatkon Room ID

date 1/29/2021

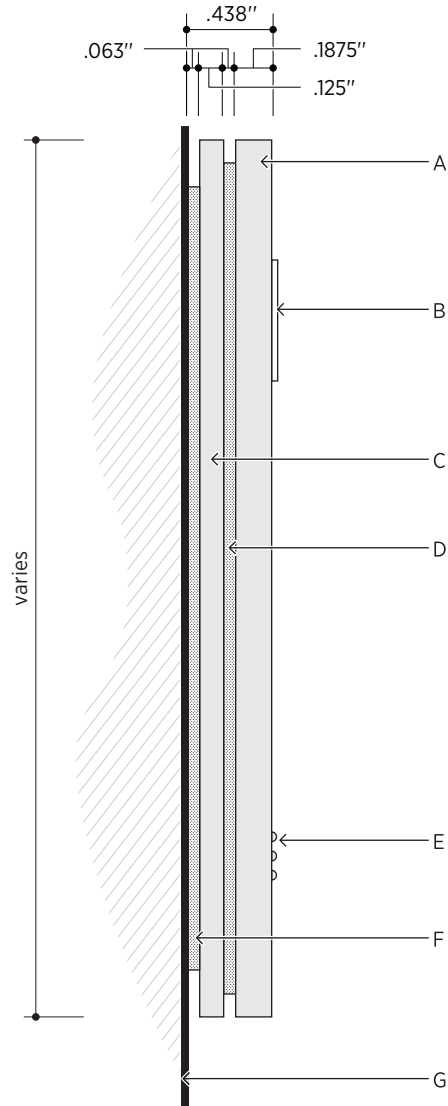
proj. no. WV18225

scale 1:2

Balch Hall Renovation - Cornell University

399





**Notes**

- |   |  |
|---|--|
| A Thermoformed acrylic plaque, polished edges, graphics reverse printed on second surface, painted second surface | E Clear Grade II Braille                 |
| B Integral tactile text, tipped   | F 3M 4655 VHB tape and silicone adhesive |
| C Acrylic backer plaque, painted first surface on all sides   | G Mounting surface                       |
| D 3M 4655 VHB tape  |  |



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

Detail 401

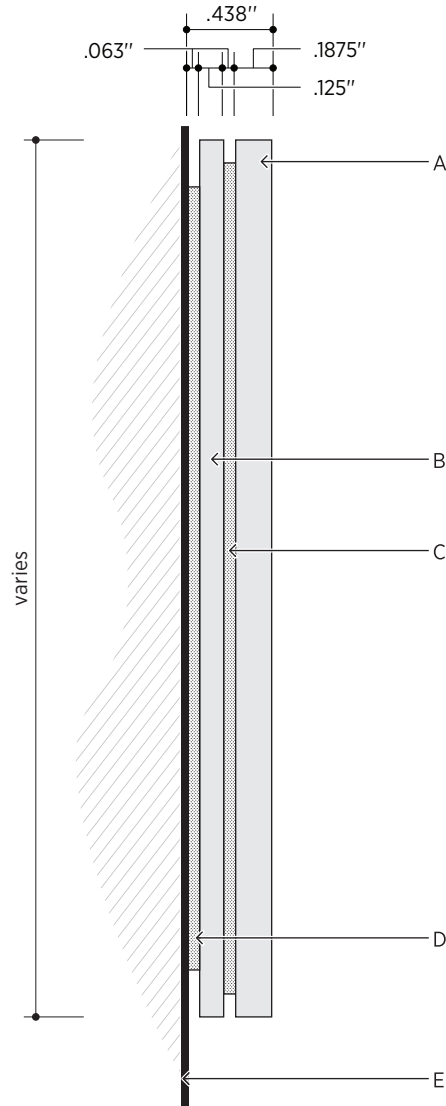
date 1/29/2021

proj. no. WV18225

scale 3" = 1' - 0"

Balch Hall Renovation - Cornell University

401



Notes

- A Acrylic plaque, polished edges, graphics reverse printed on second surface, painted second surface
- B Acrylic backer plaque, painted first surface on all sides
- C 3M 4655 VHB tape
- D 3M 4655 VHB tape and silicone adhesive
- E Mounting surface



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
781 449 1351 / whitneyveigas.com

Detail 402

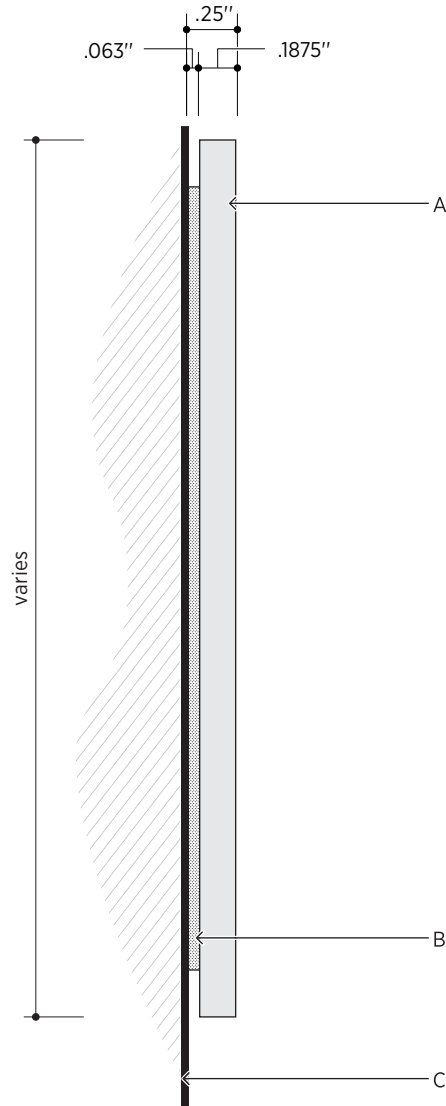
date 1/29/2021

proj. no. WV18225

scale 3" = 1' - 0"

Balch Hall Renovation - Cornell University

402



Notes

A Acrylic plaque, polished edges, graphics reverse printed on second surface, painted second surface OR Aluminum plaque, first surface painted on all sides

B 3M 4655 VHB tape and silicone adhesive  
C Mounting surface



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
781 449 1351 / whitneyveigas.com

Detail 403

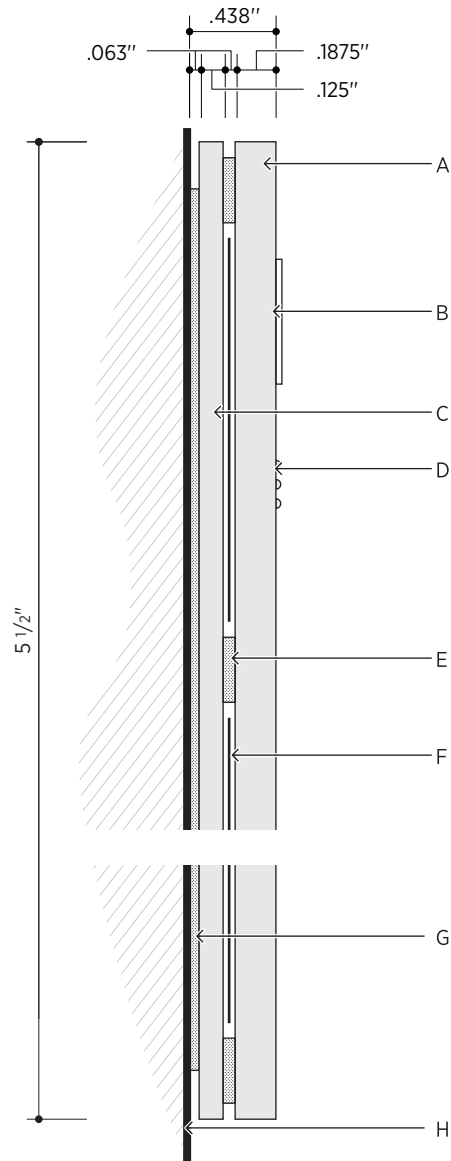
date 1/29/2021

proj. no. WV18225

scale 3" = 1' - 0"

Balch Hall Renovation - Cornell University

403



**Notes**

- |  |  |
|--|--|
| A Thermoformed acrylic plaque, polished edges, painted second surface with windows masked and left clear | E 3M 4655 VHB tape                       |
| B Integral tactile text, tipped  | F Open pocket with business card insert  |
| C Acrylic backer plaque, painted first surface on all sides  | G 3M 4655 VHB tape and silicone adhesive |
| D Clear Grade II Braille   | H Mounting surface                       |



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

**Detail 404**

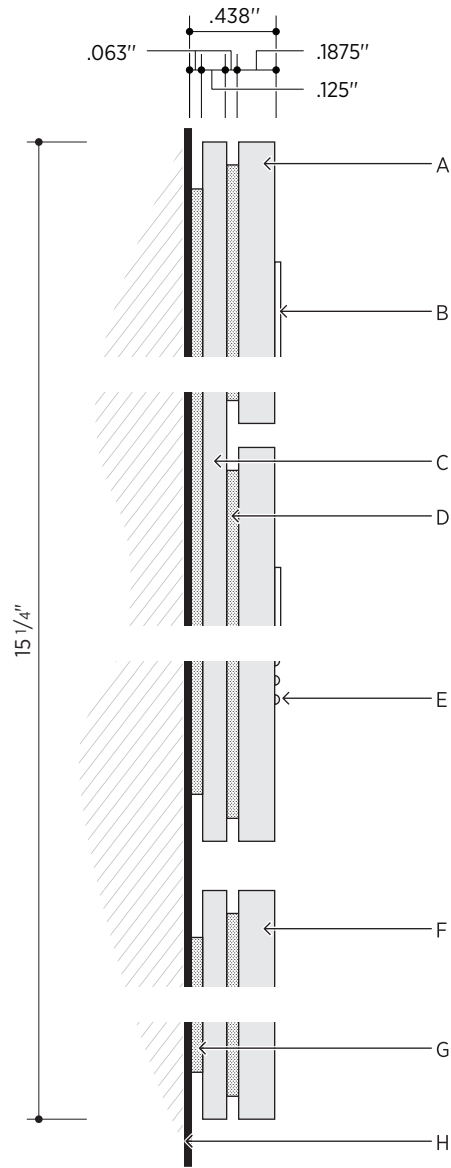
date 1/29/2021

proj. no. WV18225

scale 1:1

Balch Hall Renovation - Cornell University

404



**Notes**

- |  |   |
|--|---|
| <p>A Thermoformed acrylic plaque, polished edges, painted second surface</p> <p>B Integral tactile text, tipped</p> <p>C Acrylic backer plaque, painted first surface on all sides</p> <p>D 3M 4655 VHB tape</p> <p>E Clear Grade II Braille</p> | <p>F Acrylic plaque, polished edges, graphics reverse printed on second surface, painted second surface</p> <p>G 3M 4655 VHB tape and silicone adhesive</p> <p>H Mounting surface</p> |
|--|---|



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

**Detail 405**

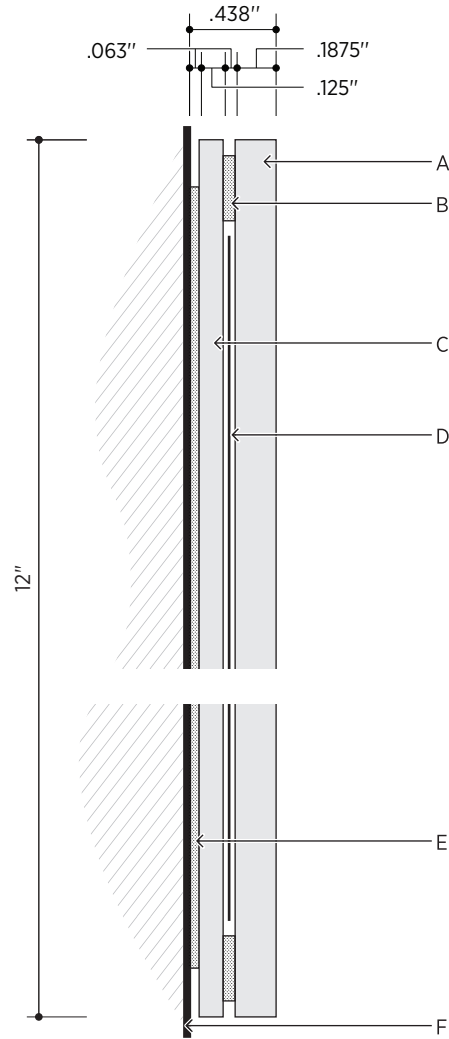
date 1/29/2021

proj. no. WV18225

Balch Hall Renovation - Cornell University

scale 3" = 1' - 0"

405



**Notes**

- A Acrylic plaque, polished edges, painted second surface with window masked and left clear
- B Acrylic backer plaque, painted first surface on all sides
- C 3M 4655 VHB tape
- D Open pocket with 8.5x11 paper insert
- E 3M 4655 VHB tape and silicone adhesive
- F Mounting surface



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

**Detail 406**

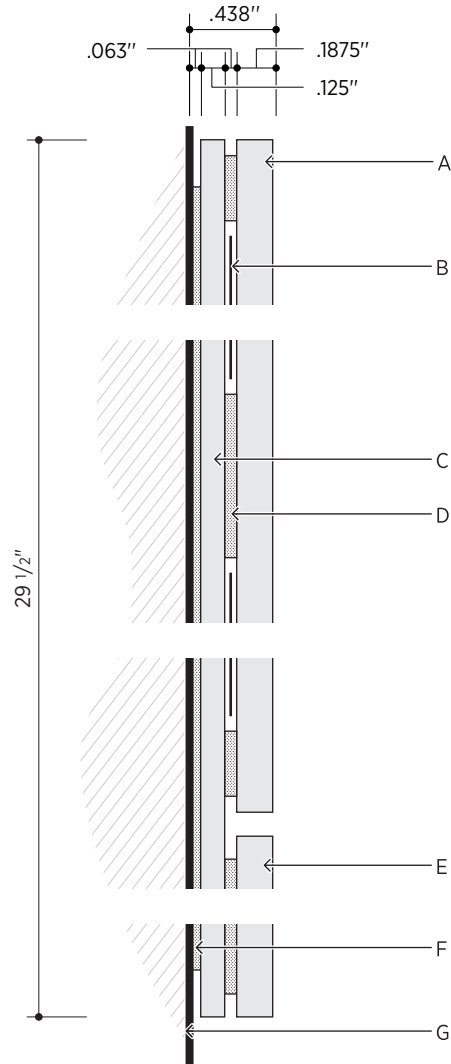
date 1/29/2021

proj. no. WV18225

Balch Hall Renovation - Cornell University

scale 3" = 1' - 0"

406



**Notes**

- |  |  |
|--|--|
| <p>A Acrylic plaque, polished edges, painted second surface with window masked and left clear</p> <p>B Acrylic backer plaque, painted first surface on all sides</p> <p>C 3M 4655 VHB tape</p> <p>D Open pocket with 8.5x11 paper insert</p> | <p>E Acrylic plaque or thermoformed acrylic plaque, polished edges, painted second surface with window masked and left clear. Integral raised graphics and clear braille where occurs.</p> <p>F 3M 4655 VHB tape and silicone adhesive</p> <p>G Mounting surface</p> |
|--|--|



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

Detail 407

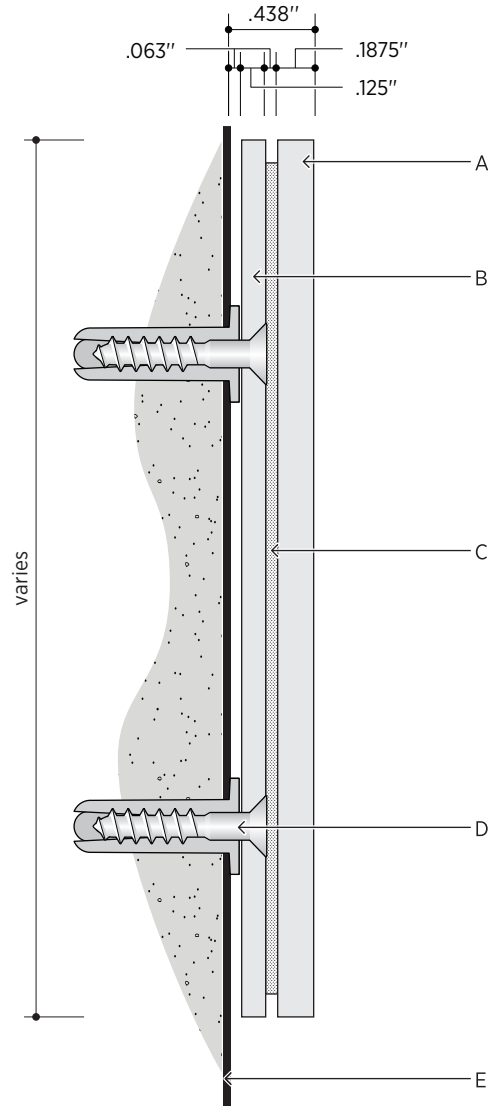
date 1/29/2021

proj. no. WV18225

Balch Hall Renovation - Cornell University

scale 3" = 1' - 0"

407



**Notes**

- |  |   |
|--|---|
| <p>A Acrylic plaque, polished edges, graphics reverse printed on second surface, painted second surface</p> <p>B Aluminum backer shim plate, painted first surface on all sides</p> <p>C 3M 4655 VHB tape and silicone</p> | <p>D Mechanical fastener and anchor as required. Fasten into mortar joints. Field position anchors and field drill shim plate as necessary.</p> <p>E Mounting surface</p> |
|--|---|



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

**Detail 408**

date 1/29/2021

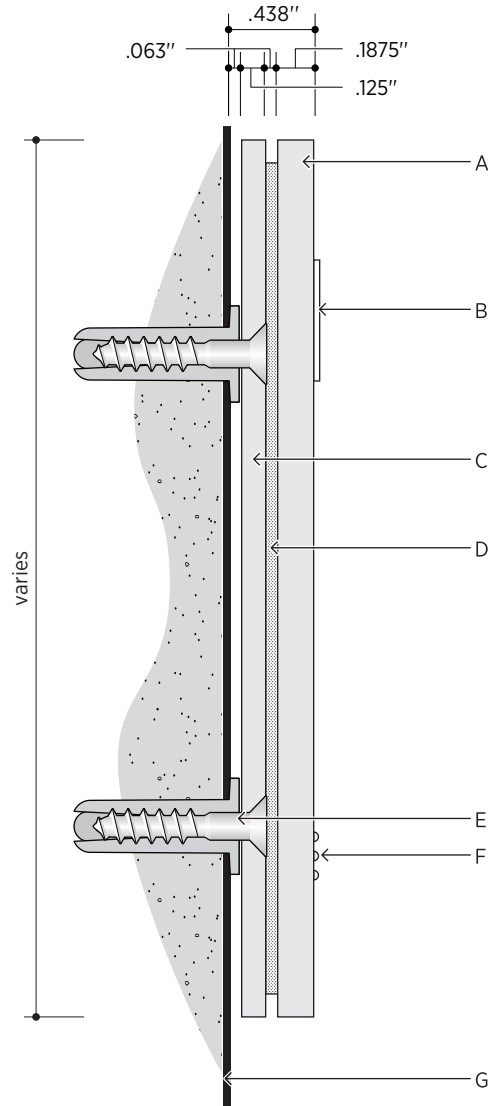
proj. no. WV18225

Balch Hall Renovation - Cornell University

scale 3" = 1' - 0"

408





**Notes**

- |   |   |
|---|---|
| <p>A Thermoformed acrylic plaque, polished edges, graphics reverse printed on second surface, painted second surface</p> <p>B Integral tactile text, tipped</p> <p>C Aluminum backer plaque, painted first surface on all sides</p> <p>D 3M 4655 VHB tape and silicone adhesive</p> | <p>E Mechanical fastener and anchor as required. Fasten into mortar joints. Field position anchors and field drill shim plate as necessary.</p> <p>F Clear Grade II Braille</p> <p>G Mounting surface</p> |
|---|---|



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

**Detail 409**

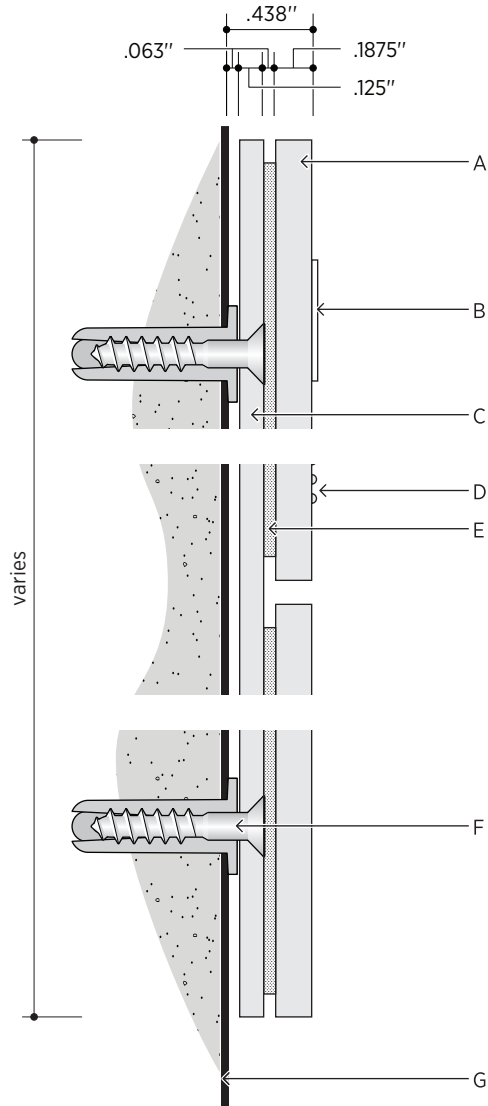
date 1/29/2021

proj. no. WV18225

scale 1:1

Balch Hall Renovation - Cornell University

409



**Notes**

- |  |   |
|--|---|
| <p>A Thermoformed acrylic plaque, polished edges, graphics reverse printed on second surface, painted second surface</p> <p>B Integral tactile text, tipped and clear Grade II Braille</p> <p>C Aluminum backer plaque, painted first surface on all sides</p> <p>D Clear Grade II Braille</p> <p>E 3M 4655 VHB tape and silicone adhesive</p> | <p>F Mechanical fastener and anchor as required. Fasten into mortar joints. Field position anchors and field drill shim plate as necessary.</p> <p>G Mounting surface</p> |
|--|---|



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

Detail 410

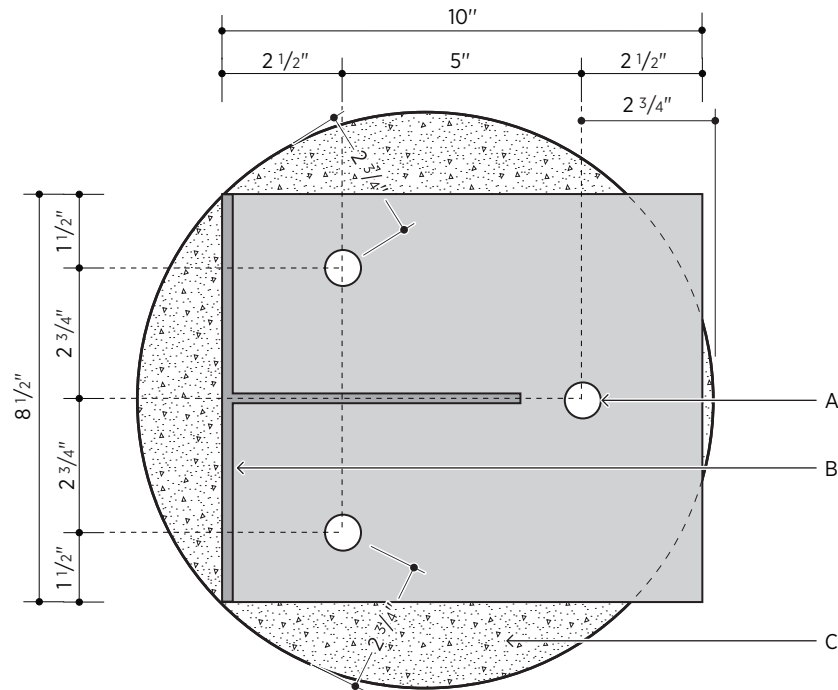
date 1/29/2021

proj. no. WV18225

scale 1:1

Balch Hall Renovation - Cornell University

410



**Notes**

- A 3/4" diameter hole
- B 1/4" thick steel plate, painted
- C Concrete footing, with 12" dia. x 36" deep sonotube



Whitney Veigas / 292 Reservoir St. / Needham, MA 02494  
 781 449 1351 / whitneyveigas.com

Detail 411

date 1/29/2021

proj. no. WV18225

scale 3=1'-0"

Balch Hall Renovation - Cornell University

411

---

Section 10 21 13  
TOILET COMPARTMENTS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Floor/wall mounted solid (black core) phenolic toilet partitions with overhead bracing.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 06 10 00 - ROUGH CARPENTRY: wood blocking.
- C. Section 09 30 00 - TILING: wall and floor tile finishes.
- D. Section 10 28 13 - TOILET ACCESSORIES: Furnishing templates, providing and installing toilet accessories surface mounted to toilet compartments, and integral with compartments.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
  - 2. ASTM A 167 - Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and strip.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Literature: Manufacturer's product data sheets, specifications, and manufacturer's warranty for each item furnished hereunder. Include information panel construction, hardware, and accessories.
  - 2. Shop drawings:

- a. 1/2 inch scale dimensioned plans and elevations of each toilet room condition showing toilet compartment layout.
  - b. Large scale design details of showing attachment clips and brackets; and complete installation details.
3. Samples:
- a. Selection samples: Manufacturer's full range of color chips, for selection by the Architect; up to two-color combinations for doors and partitions may be selected in each area.
  - b. Verification samples: 6 inch square samples of each color and finish on same substrate to be used in Work, for color verification after selections have been made.

#### 1.6 FIELD MEASUREMENTS

- A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
- B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

#### 1.7 REGULATORY REQUIREMENTS

- A. Partition Fire Resistance Rating: NFPA, Class "A".

#### 1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.

#### 1.9 WARRANTY

- A. Warranties: Provide the following manufacturer's warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS. Manufacturer's warranties are in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.
  1. Manufacturer's written warranty, for a minimum period of 25 years from date of Project Substantial Completion. Warranty shall cover panel, pilaster and door material and manufacturing workmanship against defects.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS AND MODELS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Bobrick Washroom Equipment, Inc., Clifton Park NY. partition style "Compact Laminate, Duraline Series 2186G.67P" with the following features:
  1. Optional Class "A" Fire Resistance Rating,
  2. Door and panel height: 72 inches.

3. Floor clearance: 4-5/16 inches.
  4. Full height hardware and gap-free design.
  5. Continuous panel brackets.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Bobrick Washroom Equipment, Inc., Clifton Park NY.
  2. ASI-Global Corp., Eastanolle, GA.
  3. Accurate Partition Corp., Lyons IL.
  4. General Partitions Manufacturing Corp., Deer Park NY.

## 2.2 FABRICATION

- A. Pilasters (stiles) and doors: 3/4 inch [19 mm] thick, solid phenolic (black) core with integrally bonded decorative "matte finish" melamine surface on both sides, in custom color/pattern as specified. Laminated surfaces are not acceptable.
1. Door widths; except as otherwise indicated, provide the following widths:
    - a. Standard stalls, 24 inches (minimum).
    - b. Handicapped accessible stalls, 32 inch clearance (minimum), refer to Drawings.
  2. Door height: 72 inches minimum, Routed No Sight with Hidden Hardware.
  3. Pilasters (stiles) shall run minimum 84 inches in height, (floor to head rail with secure attachment at both ends).
  4. Height above floor: Compartments to be mounted 4-5/16 inches above finished floor, except where otherwise noted.
  5. Factory pre-drill doors and pilasters for hinges and hardware.
- B. Panels: 1/2 inch [13 mm] thick, of same material and finish as pilasters and doors.
- C. Head rails: Hollow extruded aluminum tube with anti-grip top having wall thickness of not less than 0.125 inches; with cast aluminum or stainless socket brackets. Provide corner brackets, wall brackets and end caps as required.
- D. Pilaster floor and ceiling shoes: 5 inches high formed stainless steel with satin finish.
- E. Hardware and fittings: Type 302/304 stainless steel, except as specified otherwise.
1. Door hinges: Gravity type self-closing hinges fabricated from 14 gage type 302/304 cast stainless steel with a satin finish. Hinges shall be fully adjustable up to 360 degrees, with a type 302/304 stainless steel pivot pin.
  2. Door latch with nylon slides. Door keeper, one piece 14 gage stainless steel.
    - a. Latch to show "Vacant" when unlocked, and "Occupied" when locked.
  3. Door stop: 14 gage stainless steel. Plated zinc aluminum alloy door stops are not acceptable.
  4. Panel to stile connection: Full panel height "U" shape stainless steel channel.

5. Panel to wall connection: Full panel height "U" shape stainless steel channel or "Double T" shape extruded aluminum channel, clear anodized.

### 2.3 ACCESSORIES

- A. Equip all compartment doors with combination coat hook and bumper, locate as indicated on Drawings.
- B. Anchorages and Fasteners: Through-bolted stainless steel with theft-resistant heads. Chrome plated steel or brass are not acceptable.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify correct spacing of plumbing fixtures.
- C. Ensure wall blocking is coordinated with location of anchors before commencing with installation.
- D. Beginning of installation means acceptance of existing conditions.

### 3.2 INSTALLATION - GENERAL

- A. Comply with manufacturer's recommended procedures and installation sequence, and as specified herein.
- B. Install pilasters, partitions, and doors rigid, straight, plumb and level. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Set pilaster units with anchorages having minimum 2 inches penetration into structural floor, unless otherwise recommended by partition manufacturer.
- D. Attach panel brackets securely to walls using anchor devices.
- E. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.
- F. Hang door and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- G. Ensure that all holes in partitions, as required for attachment of related items, are accurately located and drilled, in accordance with the templates furnished by the accessory manufacturer. Conceal all evidence of drilling, cutting, and fitting in the finished work.
- H. No permanent exposed to view labels of any kind will be permitted to remain on the partitions, headrails, or doors.

3.3 FIELD QUALITY CONTROL

- A. Ensure that all work is free from dents, tool marks, warpage, buckle, open joints, or other defects. Protect compartments during erection, and after erection, and until final approval of the entire project by the Architect.

3.4 ADJUSTMENT

- A. Adjust and align hardware to provide a uniform clearance at vertical edges of doors not to exceed 3/16 inch.
- B. Adjust hinges to locate doors in partial-open position (approximately 30 degrees open) when unlatched. Return outswing doors to closed position.
- C. Test operation of movable parts, and make all adjustments necessary to ensure proper operation.

3.5 CLEANING

- A. Upon completion of the installation, remove all evidence of tapes and other packing materials; touch-up all scratches and surface defects and thoroughly clean and polish all exposed to view surfaces.
- B. Provide protection as necessary to prevent damage during remainder of construction period.

End of Section



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Section 10 28 13  
TOILET ACCESSORIES

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install toilet, bath and custodial accessories.
- B. Furnish and install baby changing tables.
- C. Furnish and install protection padding for exposed piping.
- D. Furnish concealed anchorage devices for handicap handrails for installation under Section 06 10 00 - Rough Carpentry.
- E. Furnish toilet and bath accessory templates, to locate anchorage reinforcement, to trades responsible.
- F. Furnish and install Owner furnished toilet, bath and custodial accessories (OFCI).

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.
- C. Section 09 29 00 - GYPSUM BOARD: Gypsum board partitions and metal framing.
- D. Section 09 30 00 - TILING: Tiled walls as substrate for toilet accessories.
- E. Section 10 21 13 - TOILET COMPARTMENTS.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
- B. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People.

## 1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, for each item furnished hereunder.
  2. Schedule: Complete schedule, indicating types, quantity, and model numbers of accessories for each location in which the accessories will be installed.
  3. Selection samples: Sample color chips indicating each manufacturer's full range of colors available for selection by Architect.
  4. Verification samples: Complete units, as requested by Architect.
  5. Sustainable Design Submittals:
    - a. Provide the following LEED submittal items:
      - 1) All relevant supporting documentation, as required by LEED v4 and as detailed in Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS.
      - 2) A completed LEED Materials Reporting Form, per Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS.

## 1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable codes and accessibility regulations, and comply with ANSI A 117.1 for installation of work.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers or bundles bearing brand name, identification of manufacturer or supplier and item identification number corresponding with approved schedule.
- B. Store materials inside, under cover, and in manner to keep them dry, protected from weather, surface contamination, corrosion and damage from construction traffic and other causes.

## 1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.
- B. Coordinate the work of this Section with placement of internal wall reinforcement.

## 1.9 WARRANTY

- A. Warranties: Provide applicable manufacturer's standard warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.

## **PART 2 - PRODUCTS**

### 2.1 MANUFACTURERS

- A. Acceptable Manufactures and models: To establish a standard of quality, design, function desired, and appearance, Drawings and specifications have been based

on manufacturers and model numbers specified herein below. Manufacturers offering products which may be considered as equal include the following:

1. A&J Washroom Accessories, Inc., (A&J) New Windsor NY.
2. American Specialties, Inc. (ASI), Yonkers NY.
3. Bobrick Washroom Equipment, Inc. (Bobrick), Clifton Park NY.
4. Bradley Corporation / Washroom Accessories Division, (Bradley) Menomonee Falls, WI.
5. VonDrehle Corporation, Hickory NC.

## 2.2 TOILET ACCESSORIES

- A. Baby changing station: Surface mounted diaper changing station equal to Koala Kare Products (Division of Bobrick), Stainless Steel Surface Mounted Horizontal Design (Model KB110-SSWM) having the following features:
1. Sanitary Liner Dispenser: Koala Kare Products Model KB134-SSLD (Stainless Steel), holds 25 sanitary liners.
  2. Construction: 18 gage Type 302/304 stainless steel exterior finish with FDA approved blow-molded high-density grey polyethylene (HDPE) liner with Microban antimicrobial interior.
  3. Horizontal format design, protruding from wall not more than 4 inches (102mm) from wall when in retracted position.
    - a. Hinges: Reinforced full-length steel-on-steel hinge with integrated steel hook plate.
    - b. Mounting supports: 11-gage steel mounting plates on 32 inch centers.. Secure with Tamper resistant fasteners.
    - c. Operation: Opens and closes with pneumatic gas spring mechanism in concealed cylinder.
  4. Performance: Units exceed static load requirements called out by ASTM F2285, Standard Consumer Safety Performance Specification for Diaper Changing Stations for Commercial Use..
  5. Equip changing station with integral liner dispenser, 2 built-in bag hooks, and child protection safety straps with cam buckle adjustable with one hand.
  6. Instruction graphics/written instructions shall be printed for visibility and permanently engraved into plastic or metal for resistance to vandalism.
  7. Mounting supports: 11-gage steel mounting plates on 32 inch centers.. Secure with Tamper resistant fasteners.
  8. Provide safety strap and harness to be secured at four points, closure to be a buckle type. Straps to be replaceable, snap-lock, nylon protective holding straps.
  9. Unit is to resist bacterial growth. Provide test results that conform to ASTM G-222.
  10. Unit to be cycle tested by licensed independent testing lab for at least 50,000 operations.
  11. Warranty: Furnish manufacturer's 5 year limited warranty on materials and workmanship, and 5 year replacement warranty against vandalism.

- 
- B. Coat/robe hook: Surface mounted bright polished finish stainless steel double robe hook, fabricated from 22 gage type 304 stainless steel, protrudes from wall nominally 1-7/8 inches.
1. Coat/robe hook Locations:
    - a. Provide one hook on the toilet side of all doors to all toilet rooms, and toilet stalls.
  2. Coat/robe hook models:
    - a. A&J model N°. UX112.
    - b. ASI model N°. 7345-B.
    - c. Bobrick model N°. B-7672.
    - d. Bradley model N°. (n/a).
- C. Grab bars (of lengths and configurations as indicated on Drawings): Stainless steel, minimum wall thickness 18 gage (Stub's gage), with non-slip knurled, peened or striated surface.
1. Grab bars: 1-1/4 inch diameter with satin finished ends, concealed 1/8 inch thick mounting flange with snap-on cover, equal to:
    - a. A&J model N°. UG2.
    - b. ASI series 3700.
    - c. Bobrick series B-5806.99
    - d. Bradley series 832.
- D. Mop and broom holders: Surface mounted, nominal 44 inch long stainless steel unit with 18 gage 8 inch deep continuous shelf, 5 stainless hooks and 4 mop/broom holders, anti-slip spring loaded, rubber cam mop holders, capable of holding 7/8 to 1-1/4 inch diameter handles.
1. A&J model N°. UJ45B.
  2. ASI model N°. 1308-4.
  3. Bobrick model N°. B-239-44.
  4. Bradley model N°. 9934.
- E. Sanitary napkin dispenser: Bobric (B-370639) Trimline Series or approved equal, surface mounted.
- F. Sanitary napkin disposal: urface-mounted White plastic surface mounted (Impact Products 25125200) or approved equal with self-closing panel.
- G. Shower seat, folding type with cushion shall have a frame constructed of type-304, satin finish stainless steel. Seat cushion shall be 1-1/2 inches thick foam padding mounted on 1/ inch thick plywood and covered in water-resistant reinforced vinyl fabric. Seat shall be able to lock in upright position when not in use and comply with ADA Accessibility Guidelines (ADAAG). Seat supports shall not come into contact with floor. Provide left or right hand seat.
1. Acceptable models:
    - a. A&J model N°. U933-1AR or u933-1AL, as indicated.
    - b. ASI model N°. 8205R or 8205L as indicated.
    - c. Bobrick model N°. B517 or B518, as indicated.

d. Bradley model N°. (n/a).

- H. Soap dispenser: Deb Soap - Proline Curved Black 1 liter Unit (SBS 91 128) soap dispenser, wall mounted (Furnished by Cornell University and installed by Contractor, OFCI).
- I. Toilet tissue dispenser, double roll type: Double Toilet Tissue Fixture GP Compact Coreless Tissue Fixture (enclosed or partially enclosed unit) or approved equal.
- J. Paper Towel Dispensers - Roll Towel Type Dispenser that accept an 8" standard roll. Dispensers shall be either push handle type or automatic feed, mounted per the ADA Mounting Heights Diagram included with this Standard. (Semi- recessed or surface mounted units shall not interfere with clear fixture areas, door approaches or accessible routes). Georgia Pacific Push Paddle Dispenser (GP-54338),
- K. Trash containers: Slim Jim Waste Container (RMD 3540), 32 gallon Brute (RMD2632) or approved equal

### 2.3 ADA PIPING PROTECTION

- A. Specified Product (Basis of Design): IPS Corporation, Collierville, TN., product "Soft Guard Plus".
  - 1. Description: 1/8 inch thick pliable PVC Shell finish Soft Guard Plus on all drainage piping including hot and cold water valve and supplies under lavatories to comply with ADA and UPC standards. Covers shall be secured by custom fit, tamper-resistant snap-to-lock fasteners.
  - 2. Complies with ICC/ANSI A117.1 (sec 606.6).
  - 3. PVC Base Insulation Material, Class A rated complying with 25 Flame Spread/450 Smoke Index (tested under ASTM E-84).

### 2.4 LOCKS

- A. General: All locks shall be keyed alike. Provide four (4) keys, for lockable accessories, to the Owner.

### 2.5 INSTALLATION ACCESSORIES

- A. Fasteners, screws, and bolts: Type 304 stainless, tamperproof.
- B. Expansion shields: Fiber, lead or rubber as recommended by accessory manufacturer for component and substrate.

### 2.6 FABRICATION

- A. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion, scratches or dents. Weld and grind smooth joints of fabricated components.
- B. Back paint components where contact is made with building finishes to prevent electrolysis.

- C. Shop assemble components and package complete with anchors and fittings. Hot dip galvanize exposed and painted ferrous metal and fastening devices. Provide steel anchor plates, adapters, and anchor components for installation.

## 2.7 FACTORY FINISHING

- A. Ferrous metals: Clean and treat, spray apply one coat of baked-on rust and moisture-resistant primer, followed by two coats of baked-on synthetic enamel, in selected colors. Ensure that finish coating is uniform in color intensity and degree of gloss, throughout.
- B. Chrome/Nickel Plating: ASTM 456, Type SC2, satin finish.
- C. Stainless steel: Number 4 satin finish, except as otherwise specified above under the Article entitled "Toilet Accessories".

## **PART 3 - EXECUTION**

### 3.1 PREPARATION

- A. Provide templates and rough-in measurements as required. Deliver inserts and rough-in frames to site at appropriate times for building-in by other trades
- B. Coordinate with trades responsible for providing receiving surfaces on which accessories will be installed.
- C. Exact locations of accessories within each room or area shall be as directed by the Architect.

### 3.2 INSTALLATION

- A. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.
- B. Install toilet accessories absolutely level and in true line, securely and rigidly anchored with theft proof fasteners of the size and type most appropriate for the specific receiving surface, concealing the fasteners as far as practicable.

### 3.3 ADJUSTING

- A. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

### 3.4 CLEANING

- A. Remove all protective films and coverings from accessories, and clean and polish each piece. Remove all rubbish, packing materials, and debris, caused by the work of this Section.

End of Section

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Section 10 40 00  
SAFETY SPECIALTIES

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
  - 1. Fire extinguisher cabinets.
  - 2. Fire extinguishers.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood rough-in framing and blocking.
- C. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Framed wall openings
- D. Section 09 29 00 - GYPSUM BOARD: Gypsum wallboard finishes.
- E. Division 21 - FIRE SUPPRESSION: Fire hose connections and related cabinets and accessories.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.
  - 1. NFPA 10 – Standard for Portable Fire Extinguishers, 2018 Edition.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Literature: Manufacturer's product data sheets, indicating: fabrication specifications, finishes, dimensions of cabinet and rough opening, and installation instructions.
  - 2. Shop drawings:
    - a. Floor plans showing all fire extinguisher cabinet and bracket locations. Indicate extinguisher and cabinet types.
    - b. Large scale details showing unit dimensions, methods of construction, attachment clips and brackets; and complete installation details.



3. Selection samples: Samples indicating metal finishes available for selection by Architect.
  - a. Provide additional samples as requested by Architect to facilitate initial selection of colors and finishes.
4. Verification samples: Fire extinguisher cabinet in specified size, finishes, and door type, if requested by Architect.

#### 1.6 REGULATORY REQUIREMENTS

- A. Obtain certificate of compliance from authority having jurisdiction indicating approval of fire extinguisher cabinets and their installed locations.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver cabinets or extinguishers to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Store cabinets and extinguishers inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
  1. J.L. Industries, (Division of Activar Inc.). Bloomington MN.
  2. Larsen Manufacturing Co., Minneapolis MN.
  3. Potter-Roemer, Union NJ.
  4. Williams Brothers Corporation, Scarborough, Ontario, Canada (cabinets).
  5. Strike first Corporation of America, Front Royal, VA (extinguishers).

#### 2.2 FIRE EXTINGUISHERS CABINETS

- A. Fire extinguisher cabinets:
  1. Cabinet construction:
    - a. Non-rated cabinet construction: 18 gage cold-rolled steel with factory applied baked acrylic enamel corrosion-resistant finish.
    - b. Fire-resistance rated cabinet construction for up-to a two hour wall rating: 18 gage cold-rolled steel double wall construction with fire barrier material lining in compliance with ASTM E-814 (UL1479). Provide cabinet with factory applied baked acrylic enamel corrosion-resistant finish.
    - c. Cabinet color: white.
  2. Cabinet trim style: Nominal 5/16 inch depth flat trim, fully recessed cabinet.
  3. Door: Cold-rolled steel with factory applied white thermally fused polyester coating, acceptable to receive a field applied recoating.

- a. Style: Vertical duo design with clear tempered safety glass.
- b. Style: Solid panel doors.
- a. Door Handle: Door handle matching material and finish of door.
- b. Lettering: Factory furnished decals for field application, as directed by Architect.
  - 1) Pattern: Vertical reading.
  - 2) Color: Black
- 4. Acceptable models for non-fire-resistant rated assemblies:
  - a. JL Industries "Ambassador Series", model number 1015
  - b. Larsen "Architectural Series", model number 2409-R2
  - c. Potter-Roemer, "Alta Series", model number 7020
- 5. Acceptable models for fire-resistant rated assemblies:
  - a. JL Industries "Ambassador Series", model number 1015-FX
  - b. Larsen "Architectural Series", model number FS-2409-R2
  - c. Potter-Roemer, "Alta Series", model number FRC-7020

### 2.3 FIRE EXTINGUISHERS

- A. Extinguishers: Non-toxic Multi-purpose dry chemical type (mono ammonium phosphate), 5 pound capacity, multi-purpose rated '3A, 40B:C'; Heavy Duty DOT Steel Cylinder Extinguisher with metal valves and siphon tubes, replaceable molded valve stem seals, corrosion and impact resistant polyester/epoxy paint finish, pull pin-upright squeeze grip operation, and pressure gauges.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify that prepared openings are ready to receive extinguisher cabinets.
- C. Beginning of installation means acceptance of project conditions.

### 3.2 INSTALLATION

- A. Install fire extinguisher cabinets in accordance with manufacturer's instructions in locations indicated, and as additionally directed by regulatory authority having jurisdiction.
- B. Do not commence installation of fire extinguisher cabinets until immediately adjacent surfaces have been completely installed and finished.
- C. Install cabinets absolutely level and in true line, with units securely anchored to the surrounding construction. Fit trim pieces accurately and tight to adjacent construction.
  - 1. Maximum variation from plumb and level: 1/8 inch.
  - 2. Maximum offset from true dimensional alignment: 1/4 inch.

3.3 CLEANING AND ADJUSTMENT

- A. Upon completion of the work of this Section in any given area, remove tools, and all packaging and debris from the work area; leave area in broom-clean condition.
  
- B. After adjacent work is complete:
  - 1. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.
  - 2. Remove all tape and other packing materials from fire extinguisher cabinets .
  - 3. Thoroughly clean and polish all exterior and interior surfaces of extinguisher cabinets, take care to remove dirt from corners. Clean metal and [glass] [plastic] surfaces with mild cleaning agents as recommended by manufacturer.
  - 4. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

End of Section

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Section 10 56 28  
BICYCLE STORAGE RACKS

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Interior bicycle storage rack units.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 03 30 00 – CAST-IN-PLACE CONCRETE: Installation of anchors into concrete.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. General: Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
  - 2. Shop Drawings: 1/4 inch scale plans showing locations of bicycle racks and layout. Indicate plan, and vertical clearances required.
  - 3. Selection Samples:
    - a. Sample card indicating Manufacturer's full range of colors available for selection by Architect.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
  - 1. Bonds and Warranty Documentation:

- a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

## 1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Storage and Handling Requirements:
  - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

## 1.8 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
  - 1. Bike rack manufacturer's 1 year warranty, from the date of purchase, which shall ensure the product is free from defects in material and workmanship.

## PART 2 - PRODUCTS

### 2.1 BICYCLE STORAGE RACKS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Dero Bike Racks, Minneapolis, MN, Product: "Dero-Duplex,".
  - 1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    - a. Dero Bike Racks, Minneapolis, MN.
    - b. Belson Outdoors, North Aurora, IL.
    - c. Bike Security Racks Company, Inc., Wentworth NH.
- B. Two-tier, Horizontal-Storage Bike Racks fabricated from the following, or manufacturer's equivalent:
  - 1. Front uprights: 2 inch nominal square tubing having minimum wall thickness of 14 gage, minimum 0.067 inch (1.6 mm) steel.

2. Rear uprights and crossbars: 1 by 2 inch nominal square tubing having minimum wall thickness of 14 gage, minimum 0.067 inch (1.6 mm) steel.
3. Upright base: 3/16 inch thick steel plate.
4. Bike trays: Formed 14 gage, minimum 0.067 inch (1.6 mm) steel.
5. Bike tray supports: 1/2 inch diameter hot rolled steel rod for lock-retaining yoke and diagonal bracing.

## 2.2 ACCESSORIES

- A. Fasteners, screws, and bolts: Hot dip galvanized.
- B. Expansion shields: Fiber, lead or rubber as recommended by accessory manufacturer for component and substrate.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  1. Verify field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
  2. Beginning of installation means acceptance of existing substrate(s) and project conditions.

### 3.2 PREPARATION

- A. During the installation of bicycle storage units, protect the work of other trades against damage by the exercise of reasonable care and precautions. Clean, repair or replace any work so damaged and soiled.

### 3.3 INSTALLATION

- A. Do not commence installation of bicycle storage units until immediately adjacent surfaces have been completely installed and finished.
- B. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.
- C. Set bicycle storage units absolutely level and in true line, with units bolted together and to the surrounding partitions, to provide a rigid and secure installation.

### 3.4 TOLERANCES

- A. Maximum variation from plumb or level: 1/4 inch.
- B. Maximum offset from true dimensional alignment: 1/4 inch.

### 3.5 CLEANING AND TOUCH-UP

- A. Remove all tape and other packing materials from shelving and upright surfaces, and thoroughly clean all surfaces.

- B. Touch-up all scratches and other surface defects as specified herein above.

End of Section

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Section 10 81 13  
BIRD CONTROL DEVICES

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Provide all labor, supplies, equipment, materials, management and supervision to install bird-netting on the exterior of the structure to provide for the permanent exclusion of birds generally found infesting man-made structures. The bird-netting system shall not be noticeable from locations where the structure is normally viewed. Provide new bird deterrent systems, which shall consist of:
  - 1. Netting fastened to new or existing masonry joint(s) with fastener provided by Bird Deterrent manufacturer.
- B. Provide the necessary equipment to install the bird-netting system in the sections of the structure indicated on the attached drawing.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 04 20 00 - UNIT MASONRY.
- C. Section 05 12 00 - STRUCTURAL STEEL FRAMING: Exposed structural Framing.
- D. Section 05 50 00 - METAL FABRICATIONS: Exposed canopy Framing.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
  - 1. ASTM A 167 – Specifications for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
  - 2. ASTM B 221 – Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
  - 3. ASTM B241 – Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Pipe.



## 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing:
  - 1. Field Measurements
    - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
    - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
  - 2. Shop Drawings:
    - a. 1/4 inch plans indicating locations of bird control devices.
    - b. Include large scale details of items of all bird control devices to be furnished hereunder, showing proposed methods of anchorage to surrounding structure and conditions.
    - c. Include large scale details of all associated support structures required to install bird screening in compliance with Architect's intent, including any additional structural elements not shown on Architect's drawings. List all engineering specifications required to achieve Architect's intent.
  - 3. Selection Samples: Chips of all available prefinish coating colors, for selections by the Architect
  - 4. Quality standards sample: Fabricate a sample showing a typical framed section of bird screen, demonstrating component framing, stainless steel mesh, specified seaming methods, and connections. Sample section shall be minimum 24 inches in horizontal length and 48 inches in height. Provide a shop primed finish.
    - a. Provide detailed descriptions of installation requirements, access equipment and methodology, staging and work space requirements, and estimated time necessary to completely perform all bird screen installations in this work, to provide a basis for schedule coordination with other trades.
  - 5. Verification Samples:
    - a. 12 inch samples of factory-applied coatings and colors proposed for use for approval prior to coating application.

- b. Fabricate a sample showing a typical section of bird control. Sample section shall be minimum 24 inches in horizontal length having both end and intermediate stanchions.
        - c. 24 inch length of needle/spike control device.
      - 6. Manufacturer's Instructions: Manufacturer's written installation instructions.
    - B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
      - 1. Bonds and Warranty Documentation:
        - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.
- 1.7 QUALITY ASSURANCE
- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
  - B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of bird control system.
  - C. Qualifications:
    - 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
- 1.8 MOCK-UPS
- A. Provide mock-up under provisions of Section 01 43 39 – MOCK-UPS.
  - B. Provide mock-up areas using accepted screening panels, minimum 25 square feet, illustrating color, texture and finish, and demonstrating the minimum standard for the Work.
  - C. Locate mock-ups where directed and include all surfaces and materials scheduled to receive a field applied finish.
  - D. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
  - E. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.
- 1.9 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:
    - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
    - 2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.

- B. Storage and Handling Requirements:
  - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

#### 1.10 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manufacturer Warranty: In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.
- C. Special Warranty: The Installer shall guarantee workmanship, materials and effectiveness of installation for a period of not less than five years from the date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on BirdMaster Bird Control Systems, 13 Linnell Circle, Billerica, MA. 01821. 1-800-562-2473.
  - 1. No substitution will be accepted.

#### 2.2 PRODUCT DESCRIPTION

- A. Model Designations:
  - 1. PermaNet Neutralite™ Total Bird Exclusion System
  - 2. PermaMesh™ Total Bird Exclusion System

#### 2.3 MATERIALS

- A. Model netting: 8/3, knotted multi twine, Ciba U.V. resistant polyethylene material in a matte neutral gray finish. Netting twine shall be a maximum 0.0118 inch diameter and have a knotted square strength of at least 24 pounds, with a maximum ¾ inch (20.5mm) square mesh size.
- B. Cable framework: maximum of 1/16 inch diameter stainless steel and shall be supported by stainless steel screw eyes with an inside eye diameter not exceeding 3/16 inch. Netting to framework connectors shall be stainless steel crimps with a maximum closed inside diameter of 3/16 inch.

- C. Stainless steel wire mesh shall be  $\frac{3}{4}$  inch square mesh, PVC coating in a matte black color.

## 2.4 MATERIALS SOURCE

- A. All parts and accessories including "PermaNet NeutraLite" shall be from the sole source manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Verify clearances required for bird control devices.
  - 2. Beginning of installation means acceptance of existing substrate and project conditions.

### 3.2 PREPARATION

- A. Thoroughly clean substrate surfaces prior to installation; remove all bird droppings, oil, grease, dirt, dust, loose paint and debris.
  - 1. Bird droppings shall be removed in a safe manner; large quantities shall be removed and disposed of by reputable waste removal companies.
- B. Remove or repair articles that may damage the bird netting after installation, such as tree limbs, brush, and loose parts of the building.
- C. Protection of In-situ Conditions: During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.

### 3.3 INSTALLATION

- A. Install bird control devices in strict accordance with Manufacturers' written instructions. Install using anchorage methods appropriate for substrate.
- B. Install bird control devices to provide coverage for full depth of surface, not just perimeter. Cut strips to follow all angles and contours closely. Provide number of parallel rows as recommended by manufacturer.
- C. Visually inspect needle system for poor adherence to mounting surfaces, or other problems related to poor installation or surface preparation. Repair or adjust as necessary immediately.

### 3.4 CLEANING

- A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

3.5 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

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Section 11 31 00  
RESIDENTIAL APPLIANCES

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Provide residential appliances, including the following:
  - 1. Kitchenettes:
    - a. Microwave.
    - b. Refrigerator.
  - 2. Apartment – FIR:
    - a. Refrigerator
    - b. Cooktop
    - c. Range hood.
    - d. Wall oven

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 06 40 00 - ARCHITECTURAL WOODWORK: Kitchen cabinets.
- C. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING:
  - 1. Exhaust ducts to range hoods, (including connections).
  - 2. Exhaust ducts to clothes dryers, (including connections).
- D. Division 26 - ELECTRICAL: Electrical supply to appliances.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
  - 1. Literature: Manufacturer's product data sheets and specifications, for each product installed and furnished hereunder clearly indicating configurations, sizes, materials, finishes, locations, utility connections and locations. Include information on accessories and options.
  - 2. Manufacturer's installation instructions: Indicate special procedures, perimeter conditions and conditions requiring special attention.

3. Manufacturer's certificates: Certify that Products provided under this Section meet or exceed UL and specified requirements.
  4. Manufacturer's sample warranties.
  5. Shop drawings for coordination: Provide dimensioned locations for utility connections.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Manufacturer's warranties: Include coverage of installed equipment.
  2. Maintenance Data: Include lubrication and periodic maintenance requirement schedules.
- 1.5 REGULATORY REQUIREMENTS
- A. Products requiring electrical connections: Listed and classified by UL, as suitable for the purpose specified and indicated.
- B. Provide and install the work of this Section in conformance with all applicable federal, state and municipal codes, laws and regulations regarding utilities, health, fire protection and safety.
- 1.6 QUALITY ASSURANCE
- A. Certification labels: Provide residential equipment which complies with standards and bears certification labels as follows:
1. Energy ratings: Provide energy guide labels with energy cost analysis (annual operating costs) and energy information as required by Federal Trade Commission.
  2. UL standards: Provide residential equipment with UL labels.
- 1.7 DELIVERY, STORAGE AND HANDLING
- A. Store all materials in original packaging in protected interior location.
- B. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows or doors to place and install the work of this Section shall be performed at not additional cost to the Owner.
- 1.8 WARRANTY
- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. General: Provide products of same manufacturer for each type of residential appliance required. To greatest extent possible, provide equipment by single manufacturer for entire project.

1. In kitchens, provide appliances with matching color and style. When equipment is by more than one manufacturer, provide units matching
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following:
1. Air King Ventilation Products, West Chester PA.
  2. Alliance Laundry Systems LLC (Speed Queen), Ripon, WI
  3. Amana Refrigeration, Inc, Amana IL.
  4. Robert Bosch LLC, Farmington Hills, MI.
  5. Broan Manufacturing Company, Inc., Hartford WI.
  6. Frigidaire Corp./ Division of Electrolux Home Products Inc., Martinez, GA.
  7. General Electric Company, (GE) Appliances Division, Louisville KY.,
  8. KitchenAid Company (division of Whirlpool Corp), St. Joseph, MI.
  9. LG Electronics Corporation, Englewood Cliffs, NJ.
  10. Maytag Company, Magic Chef Division, Cleveland TN.
  11. Nu Tone Inc., Cincinnati OH.
  12. Panasonic Company, Secaucus NJ.
  13. Scotsman, Vernon Hills IL.
  14. Sub-zero Freezer Company, Inc., Madison WI.
  15. Thermador-Waste King Division, Masco Corp. Los Angeles CA.
  16. U-Line Corporation, Milwaukee, WI.
  17. Vent-a-Hood Company. Richardson TX.
  18. Whirlpool Corporation, Benton Harbor MI.

## 2.2 EQUIPMENT

- A. Appliance Models: Refer to appliance schedule, and schedule of 'responsibilities' on Drawings.
1. All eligible equipment: Energy Star labeled.
  2. Equip ranges and cooktops with ignition prevention burners.
- B. Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories.

## 2.3 FINISHES

- A. Finish Colors: Provide manufacturer's standard colors as selected by Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify the Contractor, and copy to Architect, in writing of any conditions detrimental to the proper and timely completion of the work, and do not proceed with the work until said conditions are corrected.



- B. Verify clearances required for equipment.
- C. Verify ventilation outlets, service connections, and supports are correct and in required location.
- D. Verify that electric power is available and of the correct characteristics.
- E. Beginning of installation means acceptance of existing site conditions.

### 3.2 INSTALLATION

- A. Install each product in accordance with manufacturers' instructions.
  - 1. Maximum variation for installed equipment, from true position of 1/16 inch in 8 feet for plumb and level and a maximum of 1/32 inch offsets in adjoining surfaces intended to be flush.
- B. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.
- C. Anchor equipment using devices appropriate for equipment, substrate and expected usage.

### 3.3 ADJUSTING

- A. Adjust work under provisions of Section 01 73 00 - EXECUTION.
- B. Adjust equipment to ensure proper working order and conditions.
- C. Remove and replace equipment creating excessive noise, or vibration.
- D. After installation is completed, insure that operating parts work freely and fit neatly. Adjust hardware and catches as required. Repair or replace damaged parts dents, buckles, abrasions, scraps or other damage affecting the appearance or serviceability.

### 3.4 CLEANING

- A. At completion of each work day, remove tools and all crating boxes, coverings, rubbish and debris from the work area; leave area in broom-clean condition.
- B. Upon completion of the work of this Section, remove tools and all crating boxes, coverings, rubbish and debris from the work area; leave area in broom-clean condition.
- C. Clean Work under provisions of Section 01 73 00 - EXECUTION:
  - 1. Wash and clean appliances.
  - 2. Clean and polish glass, plastic, hardware and accessories, fixtures and fittings.
- D. Remove protective coverings from prefinished work just prior to Owner's acceptance of facility.

End of Section

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Section 11 52 13  
PROJECTION SCREENS

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Retain or delete this article in all Sections of Project Manual.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the CT High Performance Building Standard Mandatory Requirements and LEED Green Building Rating System, of the United States Green Building Council. Refer to Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

1.2 SUMMARY

- A. Section Includes:
  - 1. Electrically operated front projection screens and controls.
- B. Related Sections:
  - 1. Division 01 (018113) "Sustainability" for sustainability requirements, where applicable.
  - 2. Division 05 Section "Metal Fabrications" for metal support framing for projection screens.
  - 3. Division 06 Section "Miscellaneous Carpentry" for wood blocking for recessed screen installation.
  - 4. Division 26 Sections for electrical service and connections including device boxes for switches and conduit, where required, for low-voltage control wiring.
  - 5. Division 27 Section "Audiovisual Systems" for remote-control interface of screens with low-voltage control interfaces, image and drop dimensions, and additional projection screen information.

1.3 DEFINITIONS

- A. Gain of Front-Projection Screens: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.
- B. Half-Gain Angle: The angle, measured from the axis of the screen surface to the most central position on a perpendicular plane through the horizontal centerline of the screen where the gain is half of the peak gain.

1.4 DESCRIPTION OF WORK

- A. Provide all labor, materials, equipment, services and accessories necessary to furnish and install the work of this Section, complete and functional, as indicated in the Contract Documents and as specified herein.
- B. The principal work of this Section includes, but may not be limited to, the following:

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PROJECTION SCREENS

1. Installation of projection screens per manufacturer instructions.
2. Provision of power distribution system as specified under Division 26.
3. Provision of conduit and boxes as shown on the drawings and specified under Division 26.
4. Painting visible surfaces as directed by Architect.
5. Adjustment of screen up and down stops as directed by Architect and AV Consultant.
6. Inspecting and insuring that the screens are free from defects.
7. Cleaning the screen surfaces; the contractor shall maintain the surfaces in dust free condition throughout the course of this contract.
8. Coordinating with the AV Contractor for low voltage connections.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
1. Manufacturers' product data for projection screens and associated accessories and devices, including installation, maintenance, and cleaning instructions.
- B. Bill of Materials:
1. Organize the Bill of Materials with the information presented in the order that it appears in this specification, in 6 columns from left to right:
    - a. Paragraph number as it appears in this specification.
    - b. Paragraph title as it appears in this specification.
    - c. Manufacturer.
    - d. Model number.
    - e. Room used in.
    - f. Image Size.
    - g. Black Drop.
    - h. Quantity.
    - i. Comments (if any are needed).

Example:

Paragraph #	Paragraph Title	Manufacturer	Model	Room	Image Size	Black Drop	Qty.	Comments
<b>Section 2.2</b>	<b>Front Projection Screens</b>							
2.2.A	Type 1 Screen	xxx	xxx	#			#	(extra drop, case finish, etc.)

- C. Shop Drawings: Show layouts and types of projection screens. Include the following:
1. For operated projection screens:
    - a. Reflected Ceiling Plan (RCP) and/or Plan drawing showing location of screen with centerline (relative to ends of screen case) identified.
    - b. Section and elevation drawings for each projection screen showing floor, ceiling, and screen, indicating screen size and dimensions for extra drop and image height above the floor. Clearly indicate location of seams in viewing surfaces, if seams are required.
    - c. Detail drawings or diagrams showing:

- 1) Location of wiring connections for electrically operated units.
  - 2) Anchorage details, including connection to supporting structure.
  - 3) Details of juncture of exposed surfaces with adjacent finishes.
  - 4) Mounting accessories or ancillary hardware.
  - 5) Wiring diagrams.
  - 6) Location of seams in viewing surfaces (if applicable).
- D. Samples for Initial Selection: For finishes of screen cases or materials, as required by the Architect.
- E. Closeout Submittals:
1. Maintenance Data: For projection screens to include in maintenance manuals.
    - a. Manufacturer's product maintenance instructions and requirements.
    - b. Schedule of screens by Room, indicating room number, screen make and model, image size, drop amount (standard, extra, etc.), screen material, and accessories.
    - c. Final versions of the Shop Drawings detailing the as-built installation conditions.
- 1.6 QUALITY ASSURANCE
- A. Manufacturer's Qualifications:
1. The Manufacturer shall be engaged full time in the production of the products herein.
- B. Contractor Qualifications:
1. The Contractor shall be an authorized dealer and service facility for the products specified herein.
  2. The Contractor shall employ its own installation staff, sub-contracting the work specified herein is not acceptable.
  3. The Contractor shall demonstrate at least one year of experience with the installation of the products specified herein.
  4. Product must be installed by technicians who are qualified and experienced in installing the specified projection screens. All electrical work should be performed by licensed electricians.
- C. Pre-installation Inspection: Conduct Pre-installation inspections as needed to verify project requirements and manufacturer's instructions.
- D. 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.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Environmental Limitations: Do not deliver or install projection screens until:
1. Spaces are enclosed and weather-tight.
  2. Wet work in spaces is complete and dry.
  3. HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  4. Other construction within spaces where screens will be installed is substantially complete.

B. Storage:

1. Store projection screens in manufacturer's protective packaging and according to manufacturer's written instructions, and in a ventilated, dry, protected area safe from harmful weather conditions.

1.8 COORDINATION

- A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, and partitions.

1.9 WARRANTY

- A. Attention is directed to provision of Closeout Submittals and applicable parts of Division 1 regarding warranties.
- B. Manufacturers shall provide their standard warranty for work specified in this Section. However, such warranty shall be in addition to and not in lieu of all other liabilities which manufacturers and the Contractor may have by law or by other provisions of the Contract Documents.
- C. Screens shall be warranted by the manufacturer not to flake, peel, separate, crack or change optical characteristics for a minimum of one year from date of purchase or eighteen months from the date of manufacture, unless subject to abuse. Mechanisms shall be warranted for one year to operate smoothly, to stop consistently without need for adjustment and to maintain original noise levels.

## PART 2 - PRODUCTS

### 2.1 GENERAL:

- A. Material and Viewing Surface: Provide screens manufactured from mildew- and flame-resistant fabric of type indicated for each type of screen specified and complying with the following requirements.
1. Screen Material: Vinyl-coated glass-fiber fabric. Screen surface can be cleaned with mild soap and water.
  2. Mildew Resistance: Provide mildew-resistant screen fabrics as determined by FS 191A/5760.
  3. Fire-Test-Response Characteristics: Provide projection-screen fabrics identical to materials that have been tested for flame resistance according to both small- and large-scale tests of NFPA 701.
  4. Seams: Where length of screen indicated exceeds maximum length produced without seams in fabric specified, provide screen with horizontal seam placed as follows:
    - a. At top of screen at juncture between extra drop length and viewing surface.
    - b. Seams are not allowed within the viewing area of the screen surface.
  5. Provide extra drop length of dimension indicated to comply with the following requirements for fabric color and location of drop length:
    - a. Color: Black.
    - b. Location: At top of screen above image area.
  6. Masking Borders: Black unless otherwise noted.
  7. Size of Viewing Surface: As indicated.
  8. Size of additional Black Drop: As indicated.
  9. Opaque backing: Provide for all front projection screens.
  10. Screens Aspect ratio will be 16:10 unless otherwise noted.
  11. Operated screens shall have heavy-duty aluminum extruded cases.
- B. Electrically Operated Screens:
1. Provide manufacturer's standard UL-labeled units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation.
  2. Single-Station Control: 3-position control switch with metal device box and cover plate for flush wall mounting and for connection to 120 VAC power supply.
  3. Multiple-Station Control: 2-position momentary-action control switch with metal device box and cover plate for flush wall mounting and for connection to low-voltage control interface to screen motor.
  4. Low-Voltage Control: Provide screen with low-voltage control. The screen motor must be controlled by the Audiovisual Control system. The control system will provide contact closures for the control of the screen
  5. Motor: Instant-reversing, end-mounted or in-roller motor of size and capacity recommended by screen manufacturer with permanently lubricated bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting.
  6. Recessed Screen Mounting:

- a. Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a min. 3/8-inch (9.5 mm) diameter metal rod with ends of rod protected by plastic caps.
  - b. Provide screen case with trim flange to receive ceiling finish.
  - c. Finish on Exposed Surfaces: Prime painted.
7. Designed to have the case installed during “rough-in” stages of construction and the fabric assembly during the “finish” stage.

## 2.2 FRONT PROJECTION SCREENS

- A. Motorized Front Projection Screen – Ceiling Recessed:
1. Motor-in-roller unit designed and fabricated for suspended mounting, with bottom of case mounted flush with finished ceiling.
  2. Features:
    - a. Screen edge tabs and tensioning cables to stretch screen fabric laterally to provide flat projection surface with black masking border around image area.
    - b. Removable bottom panel to conceal motor and roller.
    - c. Low-voltage control via AV control systems.
    - d. Aspect Ratio: 16:10 (unless otherwise noted).
  3. Screen Material:
    - a. Half Gain Viewing Angle: Minimum 75 degrees.
    - b. Gain: 0.9.
    - c. Extra Drop: As required, refer to the audiovisual drawings.
    - d. Image Size: Refer to the audiovisual drawings.
  4. Acceptable Products:
    - a. Da-Lite Tensioned Advantage Electrol series with HD Pro 0.9 material. Supply screen case with finish as approved by the Architect.
    - b. Approved equal.

### PART 3 - EXECUTION

#### 3.1 PREPERATION AND INSPECTION

- A. Examine wall, ceilings and conditions under which this work is to be performed. Notify the Architect in writing of conditions detrimental to proper completion of the work. Beginning work means that the Contractor accepts substrates and conditions
  - 1. Verify that conditions of substrates previously installed under other sections or contracts meet requirements.
  - 2. Inform Architect and AV Consultant of unacceptable conditions or unexpected changes to room immediately upon discovery.
  - 3. Continue with installation only after unacceptable conditions and changes have been reviewed, corrected, and/or removed.

#### 3.2 COORDINATION

- A. Coordinate provision of electrically and manually deployed roller screens with locations of other wall and ceiling mounted components such as visual display boards, casework, structural framing, light fixtures, air diffusers, ducts and fire sprinklers to eliminate potential conflicts.
- B. Coordinate requirements for blocking, construction of recesses, and auxiliary structural supports to ensure adequate means for installation of screens.
- C. Coordinate installation of recessed mounted screens with construction of suspended or gypsum board ceilings or wall construction.

#### 3.3 INSTALLATION

- A. Arrange for timely delivery of the screen from the manufacturer. Do not store the screen for extended periods prior to installation. Coordinate pathway access to bring the screen into the building as required.
  - 1. Verify exact project locations with Architect prior to installation
  - 2. Do not deliver projection screens until the requirements stated in Part 1 – General are met.
- B. Install screens in accordance with the approved shop drawings. Strictly comply with the manufacturer's instructions and recommendations. Comply with all requirements as specified in this Section. Comply with all referenced standards.
- C. Installation and construction work to be performed during hours satisfactory to Architect. Work may be performed during regular trade working hours or after hours depending on Owner, Architect's project requirements
- D. Install projection screens at locations and heights indicated on drawings. Verify locations in field with Architect.
- E. Provide and install blocking in all walls as required. Provide and install appropriate structural support in ceilings as required. Work ceiling tiles around openings for flush ceiling screens.
- F. Accurately plumb, level, align, square and brace screens.



- G. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
  - 1. Install low-voltage controls according to NFPA 70 and complying with manufacturer's written instructions.
    - a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
  - 2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.
  - 3. Test manually operated units to verify that screen-operating components are in optimum functioning condition.
  - 4. Protect projection screens after installation from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

#### 3.4 FINAL CLEANING, ADJUSTING, TOUCH-UP, AND REPAIR

- A. After installation of hardware, make adjustments and corrections to leave operating parts in perfect condition in accordance with Section 01 74 00 – Cleaning and Waste Management.
- B. Touch-up damaged shop coatings and repair minor damage to eliminate all evidence of repair to the satisfaction of the owner's representative.
- C. Remove and replace work that cannot be satisfactorily repaired
- D. Upon completion of work, remove surplus materials, product packaging, rubbish, tools, and equipment

#### 3.5 TESTING AND PROTECTION

- A. Operate each screen three times minimum. Ensure screens properly extend and retract and that screen is level and viewing surface plumb when extended. Adjust to correct deficiencies. Verify that the screen operates properly, and that the screen hangs flat without ripples.
- B. Protect projection screens from damage resulting from subsequent construction activities in accordance with Section 01 76 00 – Protection Installed Construction. Tape craft paper or other protective membrane over the screen housing opening until directed to remove them. If the protective materials interfere with the operation of the screen, remove power from the unit and document this action with clear and legible labeling.
- C. Remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.
- D. After the building is completely clean and prior to turning over the building to the owner for occupancy, deploy all rollup screens and allow them to hang for at least 72 hours to allow the screen fabric to relax into its natural flat and smooth shape. Remove any new debris and dust that have accumulated on the screen and exposed housing surfaces. After the 72 hour period, return the screens to the rolled up position.

End Of Section

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Section 12 24 00  
WINDOW SHADES

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Manually operated, cellular (honeycomb) shades at Bedrooms.
  - 2. Manually operated, cellular (honeycomb) shades at Upper Lounges and Historical Lounges.
  - 3. Supplementary items required for shade installation.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 10 00 - ROUGH CARPENTRY: Blocking for window shades.
- D. Section 06 20 00 - FINISH CARPENTRY: Wood trim mounting substrate for blinds.
- E. Section 09 29 00 - GYPSUM BOARD:
  - 1. Substrate for window shade systems.
  - 2. Patching existing finishes at window treatment.
- F. Section 09 51 00 - ACOUSTICAL CEILINGS: Relationship of window shades to acoustical ceilings.

1.1 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. NFPA 701 - Standard Methods of Fire Tests for Flame-resistance Textiles and Films.
  - 1. UL 214 - Standard for Tests for Flame Propagation of Fabrics and Films.

## 1.2 ADMINISTRATIVE REQUIREMENTS

### A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

### B. Sequencing:

1. Field Measurements
  - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
  - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

## 1.3 SUBMITTALS

### A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
  - a. Provide additional information required for fabric, including: Size limitations, fire resistance information. Identify available shade cloth colors and materials.
  - b. Note on submittals any deviations from specified requirements and the reasons thereof.
2. Maintenance Information: Fabric maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
3. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
4. Certifications:
  - a. Manufacturer shall submit notarized certificate indicating compliance with requirements of specifications and that specified warranty will be provided without restriction.
  - b. Certification of compliance with current building code and environmental regulations: Manufacturer shall certify that materials proposed for use comply with applicable building code and environmental regulations.
  - c. Authorization for Deviations From Specifications: If any deviations from specifications have been accepted, include written description and reasons for deviations. Include authorization for change signed by Owner, Architect, Engineer, and person submitting change. Authorization for change shall also clearly indicate party responsible for remedying defects.
5. Shop drawings:
  - a. Dimensioned 1/4 inch scale drawings, bearing dimensions of actual measurements taken at the project, where practical.

- b. Include complete fabrication details and erection drawings.
- 6. Selection Samples:
  - a. 3 by 5 inch size shade cloth and liner sample swatches indicating Manufacturer's full range of colors and patterns available for initial selection.
  - b. Provide additional shade cloth and liner samples, of size requested by Architect, to aid in the Architect's selection.
- 7. Verification Samples: One fully operational window shade sample, 24 by 24 inches complete with selected shade cloth, liner and hem bar mounted to specified roller mechanism.
- 8. LEED Submittal Requirements:
  - a. Materials & Resources Credit 2, Building Product Disclosure & Optimization-Environmental Product Declaration:
    - 1) Provide manufacturers' product documentation for each product having an Environmental Product Declaration (EPD).
      - a) Documentation should confirm EPD conforms with ISO 14205 EN 15804 or ISO 21930
      - b) EPD shall have at least Cradle to Gate scope,
    - 2) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.

#### 1.4 QUALITY ASSURANCE

- A. Obtain shade operators and fabric products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of operator.
- B. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

#### 1.5 QUALIFICATIONS

- A. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  - 2. Do not deliver shades to the project until all concrete, masonry, plaster and other wet work has been completed and is dry.
  - 3. Deliver prefabricated shades to site in labeled protective packages, uniquely identified for each intended location. Schedule delivery of panels to prevent delays of the Work, and minimize on-site storage.
- B. Storage and Handling Requirements:
  - 1. Store materials in manner recommended by shade manufacturer, inside, under cover, and in manner to keep them dry, protected from moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction traffic and other causes.

2. Do not store shade boxes on ends.

- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

#### 1.7 SITE CONDITIONS

- A. Maintain ambient temperature between 60 and 85 degrees Fahrenheit, and a relative humidity between 20 and 50 percent for a period starting 24 hours before installation of window shades, and maintain until Owner's Final Acceptance.

#### 1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

#### 1.9 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manual operating components: Manufacturer's 10 year warranty from Date of Substantial Completion of shade installation. Warranty shall include provisions that installation shall remain operational without fault and include all operating parts, except for the bead chain which is not warranted.
- C. Shade cloth: Manufacturer's 5 year warranty from Date of Substantial Completion of shade installation. Warranty shall include provision that shade cloth will not fade, deteriorate, sag or warp for the warranty period.

#### 1.10 EXTRA MATERIALS

- A. Provide to Owner, Full shade units, in quantity equal to 1 percent of units, per each size, color and type installed.
1. Provide not less than one complete shade unit per size, color and type installed.

### PART 2 – PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire performance characteristics; shade material tested in accordance with NFPA 70 1- Vertical Burn Test, rated "FR".

#### 2.2 CELLULAR SHADES

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Gordon's Window Décor, Williston, VT.

- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
  - 1. Gordon's Window Décor, Williston, VT. (Basis of Design)
  - 2. Hunter Douglas Inc., Broomfield CO.
  - 3. Kirsh (Cooper Industries, Inc.), Sturgis MI.
  - 4. Springs Window Fashions Division, Inc., Montgomery PA.
- C. Fabric: Textured, woven or non-woven polyester formed into hexagonal honeycomb cells in a stacked tubular construction, each cell being an independent piece of fabric. Construction shall a single honeycomb layer of fabric. Fabric to be cleanable/wipable and is subject to approval of Cornell University.
  - 1. Bedrooms: Provide honeycomb black-out shades.
    - a. Color(s) shall be selected from manufacturer's full available line.
  - 2. Public Spaces: Provide honeycomb light filtering shades.
    - a. Color(s) shall be selected from manufacturer's full available line.
- D. Headrail and sill rail shall be of 0.040 inch thick aluminum alloy 6063, nominally 1-7/8 inches deep by 1/2 inch high. Rails shall have grooves for end caps and installation brackets. Rails and end case shall be color coordinated with fabric.
- E. Pull cords (continuous type): braided polyester 0.0354 inches in diameter, color coordinated with shade fabric.
- F. Cordlock: molded from engineering plastic with stainless steel components, color coordinated with shade hardware.
- G. Installation brackets, Metal with holes position so they can be mounted to ceiling, soffit or wall.
- H. Provide extension brackets, spacer blocks as required by field conditions.
- I. Mounting: Wall, jamb, or overhead mounted as indicated, brackets made of 1/8 inch sheet steel to which drive assembly, idle end assembly and center support systems are attached.

### 2.3 FABRICATION

- A. Fabrication: Fabricate units to completely fill existing openings, from head-to-sill and jamb-to-jamb. Do not commence fabrication of shade units until field measurements are confirmed.
- B. Fabric shall hang straight and flat without buckling or distortion. Fabric edges shall be straight and without ravels.

### 2.4 FACTORY FINISHES

- A. Aluminum: Thermoset powder coat in manufacturer's standard color, as selected by Architect from full range of available colors.
- B. Aluminum: Thermoset powder coat in custom color, matching Architect's control sample.



- C. Aluminum: Anodized finish in selected colors.
- D. Steel parts, cadmium plated, satin finished, or bonderized prior to painting with baked enamel finish.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Ensure that supporting substrate is adequate.
- B. Beginning of installation means acceptance of existing project conditions.

#### **3.2 INSTALLATION**

- A. Install units to comply with manufacturer's instructions for type of mountings and operations required. Provide units plumb and true, securely anchored in place with recommended hardware and accessories to provide smooth, easy operation.

#### **3.3 TOLERANCES**

- A. Maximum variation of gap at window opening perimeter: 1/4 inch.
- B. Maximum offset from level: 1/8 inch.

#### **3.4 ADJUSTING**

- A. Adjust units for smooth operation. Replace any units or components which do not operate smoothly and without hindrance.

#### **3.5 CLEANING**

- A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End Of Section

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Section 12 32 00  
MANUFACTURED WOOD CASEWORK

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Provide modular casework, of types and sizes shown on the Drawings and in Schedules, complete in place, as specified herein, and as needed for a complete and proper installation.
  - 1. At accessible locations adjust cabinet box dimensions as required to meet dimensional requirements. Toe kick space shall remain consistent for all cabinet locations.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 06 40 00 - ARCHITECTURAL WOODWORK:
  - 1. All other casework not designated or specified as "Modular Casework".
  - 2. Plastic laminated countertops for cabinetry work of this Section 12 32 00.
- D. Division 22 - PLUMBING: All plumbing work related to items in this Section
- E. Division 26 - ELECTRICAL: All electrical work related to items in this Section

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - References. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM D 523 - Standard Specification for Specular Gloss.
  - 2. FSC (Forest Stewardship Council): "FSC Certification Program"
  - 3. ANSI/HPVA HP-1 – American National Standard for Hardwood and Decorative Plywood.
  - 4. ANSI / AHA A135.4 – Basic Hardboard Standard.

5. APA Grades and Specifications.
  6. National Lumber Grades Authority, American Lumber Standards, and Grading Rules and Standards of the various lumber associations whose species are being used, with grade-marks for same.
  7. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber; and Product Standard (PS):
    - a. PS-1 - Construction and Industrial Plywood Standard. (on 3/2018 this is still current)
    - b. PS-20 - American Softwood Lumber Standard.
- B. Definitions:
1. FSC: Forest Stewardship Council.
  2. HPVA: Hardwood Plywood & Veneer Association.
  3. NAUF: No added Urea Formaldehyde.

## 1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
  2. Materials schedule: A complete schedule of casework components, coordinated with the Contract Drawings.
  3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
  4. Selection samples:
    - a. Sample card indicating Manufacturer's full range of colors of laminate, edging or other surfacing material, available for selection by Architect.
    - b. Provide additional samples as requested by Architect for initial selection of colors and finishes.
  5. Verification samples: All hardware items (hardware samples will be returned to the Contractor after review).
  6. Certificates:
    - a. Chain-of-Custody: Written documentation providing evidence of compliance with Chain-of-Custody supply of wood products, and compliance with FSC.
      - 1) Demonstrate that products are FSC-certified by providing vendor invoices. Invoices will contain the vendor's chain of custody number and identify each chain of custody certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.
    - b. NAUF: Certify that all composite wood and agrifiber products used on this Project are NAUF.
      - 1) Written certification from Millworker, that only "no-added formaldehyde" (NAUF) manufactured composite panel products are to be incorporated into the Work, including all concealed

components. NAUF composite panel products include, but are not limited to, particle board (PB), oriented strand board (OSB), and medium density fiberboard (MDF) and similar manufactured products.

7. LEED Submittal Requirements:
  - a. Materials & Resources Credit 3, Building Product Disclosure & Optimization-Sourcing of Raw Materials:
    - 1) Document FSC Certification for all wood products that contribute to credit achievement by providing the following:
      - a) Itemized vendor invoices for FSC-certified products.
      - b) Chain-of-Custody (COC) certificates. Every entity that processes or trades FSC-certified material before it is shipped to the project site must have FSC CoC certification. On-site installers of FSC-certified products must have CoC certification only if they modify the products off the project site.
    - 2) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for wood products installed in the building.
  - b. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
    - 1) Recycled Content:
      - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
      - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
    - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
      - a) Documentation should be in the form of one of the following:
      - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
      - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
      - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
      - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
      - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher
    - 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
  - c. Indoor Environmental Quality Credit 3: Low-Emitting Materials (adhesives and sealants):

- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017, that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for adhesives/sealants installed within the waterproofing membrane.
- d. Indoor Environmental Quality Credit 3: Low-Emitting Materials (paints and coatings):
- 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Provide MSDS or other manufacturer documentation with disclosure of VOC content for all wet-applied products.
  - 3) Complete "LEED Materials Documentation Sheet" with IEQc2 information for paints/coatings installed within the waterproofing membrane.
- e. Indoor Environmental Quality Credit 3: Low-Emitting Materials (composite wood products):
- 1) Provide manufacturers' product data confirming that the composite wood products in the building have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for composite wood products installed within the waterproofing membrane.

1.6 QUALITY ASSURANCE

- A. Workmen: Install casework under the supervision of the manufacturer's representative with factory-trained mechanics authorized by manufacturer.

1.7 PRODUCT HANDLING

- A. Delivery and Storage: Casework shall be protected in transit. Deliver materials under protective cover and store within dry enclosed space. Do not expose to extreme temperature and humidity changes.
1. Do not store or install casework in building until concrete, masonry, and plaster work is dry.
  2. Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect, at no change in Contract Sum.

1.8 COORDINATION AND SCHEDULING

- A. Coordinate work of this Section with related work of other Sections as necessary to obtain proper installation of all items.
- B. Verify site dimensions of cabinet locations in building prior to fabrication.

**PART 2 - PRODUCTS**

2.1 WOOD MATERIALS – GENERAL REQUIREMENTS

- A. General requirements:
1. Solid wood components: New, dressed four sides (S4S), and free from warping and other defects.
  2. Panel Products: Composite panel products and plywood shall be “no added urea-formaldehyde”, including all concealed components.
    - a. Composite panel products include but are not limited to particle board (PB), Medium Density Fiberboard (MDF), wheatboard and strawboard and similar manufactured products.
  3. Moisture Content:
    - a. Solid hardwood(s) scheduled for transparent finish: Moisture content shall not exceed 8 percent when delivered to Project.
    - b. Typical (hardwood and softwoods): Moisture content of wood shall be between 5 and 10 percent when delivered to the project.
  4. Chain of Custody: All wood products furnished under this Specification Section shall be “FSC Certified” according to the rules of the Forest Stewardship Council (FSC) or “CSA-SFM Certified” according to the rules of Canadian Standards Association International (CSA) Forest Products Group Sustainable Forest Management (SFM) Program.

- a. FSC Certification includes the following certification bodies of forests and forest products:
  - 1) SCS Global Services.
  - 2) SmartWood.
  - 3) SGS Qualifor.
  - 4) Soil Association.

## 2.2 MANUFACTURERS

- A. Manufacture: To establish a standard of quality, design and function desired, Drawings and specifications have been based on KraftMaid Cabinetry, Inc. Similar products manufactured by others, may be considered as an equal by the Architect.
- B. Cabinet Door/Drawer Style: Full Overlay, KraftMaid Cabinetry "Sonora" Style.
  - 1. Wood Species: White Maple, in stained finish selected by the Architect from manufacturers' standard finishes.

## 2.3 CABINET MATERIALS

- A. Exposed Materials: Comply with the following:
  - 1. Exposed Wood Species: Maple
    - a. Unless otherwise indicated, do not use two adjacent exposed faces shall be similar that are noticeably dissimilar in color, grain, figure, and or natural character markings.
  - 2. Solid Wood: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, kiln dried to 7 percent moisture content.
  - 3. Plywood: Hardwood plywood complying with HPVA HP – 1 face veneer of species indicated, selected for compatible color and grain with Grade A faces and Grade C backs of same species as faces.
    - a. Edge band exposed edges with minimum 1/8 inch (3 mm) thick, solid-wood edging of same species as face veneer.
  - 4. Thermoset Decorative Overlay: No-Added-Urea-Formaldehyde (NAUF), of thickness indicated on the Drawings, conforming to ANSI A208.2, Grade 155, product class MR50, fabricated from 100 percent recycled fiber, using formaldehyde free synthetic resin such as methyl diisocyanate (MDI), having a minimum density of 45 pounds per cubic foot (769 kg/m<sup>3</sup>) with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
    - a. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed surfaces.
- B. Semi-exposed Materials: Unless otherwise noted, provide the following:
  - 1. Plywood: Hardwood plywood complying with HPVA HP-1 with Grade C faces and backs stained to be compatible with exposed surfaces.
  - 2. Plywood: Hardwood plywood complying with HPVA HP-1 with Grade C faces stained to be compatible with exposed surfaces and Grade 3 backs of Birch species, with clear finish.
  - 3. Plywood: Hardwood plywood complying with HPVA HP-1 with Grade C fac

4. stained to be compatible with exposed surfaces and an embossed, natural birch vinyl film adhesively bonded to the plywood.
  5. Vinyl-Faced Particleboard: Mattformed three layer medium density wood particle panel (PB), graded M2 per ANSI A 208.1 with a minimum density of 48 pounds per cubic foot with an embossed, wood grain-patterned vinyl film adhesively bonded to particleboard.
    - a. Provide vinyl film on both sides of shelves, dividers, and other components with two semi-exposed surfaces and semi-exposed edges.
- C. Concealed Materials: Comply with the following:
1. Plywood: Any hardwood or softwood species, with no defects affecting strength or utility.
  2. Particleboard: ANSI A208.1, Grade M-2
- D. Solid Wood Edges and Trim: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, kiln dried to 7 percent moisture content.
1. Wood Species: Maple.

#### 2.4 CASEWORK HARDWARE

- A. General: Manufacturer's standard units complying with BHMA A156.9, type, material, size, and finish as selected from manufacturer's standard choices.
- B. Hinges: Concealed European-style, 6-way adjustable hinges.
- C. Drawer Guides: Undermount, self-closing drawer guides, designed to prevent rebound when drawers are closed; with nylon-tired, ball bearing rollers; and complying with BHMA A156.9, type B05091.
1. Full-extension buffered runners with easy-release mechanism.
- D. Locks where indicated: to be disc tumbler lock keyed alike and master keyed. Dull chrome finish.

#### 2.5 CABINET CONSTRUCTION

- A. Face Style: Flush overlay.
- B. Face Frames: 3/4-by-1 1/2-inch (19-by-38-mm) solid wood.
- C. Door and Drawer Fronts: Solid wood stiles and rails, 3/4-inch (19mm), with 1/4-inch (6.4mm) thick, veneer-faced plywood center panels.
- D. Exposed Cabinet Ends: 3/4-inch (19mm) thick, veneer-faced plywood with maple veneer interior.
- E. Cabinet Tops and Bottoms: 1/2-inch (12.7mm) thick, vinyl-faced particleboard or 1/2-inch (12.7mm) thick natural birch veneer-faced plywood, supported by and secured in rabbet in end panels and front face frame.
- F. Base Unit Top Rails: 3/4 by 2 3/4-inch solid wood, interlocking with end panels, and secured under pressure with glue and with mechanical fasteners.



- G. Wall-Hung Unit Top and Bottom Rails: 1/2 by 2 1/2-inch solid wood, interlocking with end panels, and secured with glue and mechanical fasteners.
- H. Base Unit Back Panels: 3/8-inch vinyl-faced or veneer particleboard fastened to rear edge of end panels and to top rail.
- I. Wall-Hung Unit Backs: 3/16-inch thick plywood or 1/8-inch hardboard, captured on the end panels and fastened to the top and bottom rails.
- J. Front Face Frame Drawer Rails: 3/4-by-1 1/2-inch solid wood fastened into face frame.
- K. Drawers: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued dovetail joints.
  - 2. Subfronts, backs, and sides: 3/4-inch (19mm)-thick solid wood.
- L. Edge-band Shelves: 3/4-inch (19mm)-thick particleboard or 5/8-inch-(16mm)-thick plywood.
- M. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops bottoms, and backs into end panels.
- N. Factory Finishing: To the greatest extent possible, finish casework at the factory. Defer only final touch up until after installation.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Erect casework straight, level and plumb and securely anchor in place. Scribe and closely fit to adjacent work. Cut and fit work around pipes, ducts, etc.
- B. Install all items complete and adjust all moving parts to operate properly.
- C. Leave surface clean and free from defects at time of final acceptance.

#### **3.2 CLEANING**

- A. Clean Up: Remove all cartons, debris, sawdust, scraps, etc., and leave spaces clean and all casework ready for Owner's use.

End of Section

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Section 12 48 43  
ENTRY FLOOR MATS

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
  - 1. Sub-floor filler, as required to ensure the specified tolerance level for finish surface of matting.
  - 2. Rolled entrance matting directly adhered over floors, where indicated on the Drawings, including all accessories necessary to complete the work.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction, LEED BD+C* certificate goals.
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE.
- D. Section 06 20 00 - FINISH CARPENTRY: Installing metal thresholds.
- E. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES: Straight resilient base, where indicated in conjunction with floor mats and grilles.
- F. Section 09 68 13 – TILE CARPETING.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM D 2859 - Test Method for Flammability of Finished Textile Floor Covering Materials.
  - 2. ASTM D5116 - Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
  - 3. ASTM E 84 - Surface Burning Characteristics of Building Materials.

4. ASTM E 648 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
5. CRI Indoor Air Quality Testing and Labeling Program.
6. NFPA: Publication 253 - Test for Critical Radiant Flux of Floor Covering Systems.
7. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

##### B. Sequencing:

1. Field Measurements
  - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
  - b. Measure all areas to receive materials to be furnished and installed hereunder, and verify in the field their actual dimensions, including wall-to-wall dimensions, offsets, door locations, and details, fixed equipment, and all other installed items.
  - c. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work. Extra charges will not be allowed because of lack of familiarity with actual project conditions. Use largest floor mat widths to produce minimum number of seams. Small pieces of floor mat will not be acceptable.
2. Sequence work to ensure floor mat is not installed until sufficient heat is provided, dust generating activities have terminated and work overhead is completed.
3. Install floor mat after interior wet work is complete and fully cured.

#### 1.6 SUBMITTALS

##### A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties, for each item furnished hereunder, including floor mats and grilles, accessories, adhesives, and leveling materials. Include manufacturer's application methods or installation instructions for each item furnished hereunder.
2. Shop Drawings:
  - a. Plan Drawings: Show location and extent of walk-off mat. Plans shall be minimum 1/8 inch to foot scale.
  - b. Large scale details of edge conditions and transition to adjacent materials.

3. Selection Samples:
  - a. Sample mat swatches containing manufacturer's full color and blend range.
  - b. Sample tread insert swatches containing manufacturer's full color range.
4. Verification Samples: After initial selection of floor mat, tread insert swatches, and color blends has been made by the Architect: 18-inch by 36-inch sample of selected floor mat for final approval of the Architect. Approved samples shall be used as the standard of quality and colors for materials furnished under this Contract.
5. Certificates: Provide certificate stating that the floor mat, and other related materials to be supplied hereunder meet all requirements specified herein.
6. Sustainable Design Submittals:
  - a. Provide the following LEED submittal items:
    - 1) All relevant supporting documentation, as required by LEED v4 and as detailed in Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS.
    - 2) A completed LEED Materials Reporting Form, per Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS.
7. LEED Submittal Requirements:
  - a. Materials & Resources Credit 4, Building Product Disclosure & Optimization-Material Ingredients:
    - 1) Recycled Content:
      - a) Provide manufacturers' product documentation that includes recycled content claims for the products contributing towards compliance. Claims must conform to the definition in ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims.
      - b) Complete "LEED Materials Documentation Sheet" with MRc3 Option 2 information for products with recycled content installed in the building.
    - 2) Provide manufacturers' product documentation for each product having a publicly available material inventory down to at least 0.1% or 1000 ppm.
      - a) Documentation should be in the form of one of the following:
      - b) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
      - c) A published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
      - d) Material Health Certificate or Cradle to Cradle Certification under standard version 3 or later with a Material Health Achievement level at the Bronze level or higher.
      - e) A Declare product label indicating that all ingredients have been evaluated and disclosed down to 1000 ppm.
      - f) Cradle to Cradle Material Health Certificate at the Bronze Level or higher

- 3) Complete "LEED Materials Documentation Sheet" with MRc2 information for each product having an EPD.
- b. Indoor Environmental Quality Credit 3: Low-Emitting Materials (flooring systems):
  - 1) Provide manufacturers' or third-party certification of testing to and compliance with the California Department of Public Health (CDPH) Standard method v1.2-2017 that includes the following information:
    - a) The exposure scenario used to determine compliance.
    - b) The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.2:  
0.5 mg/m<sup>3</sup> or less;  
Between 0.5 and 5.0 mg/m<sup>3</sup>; or  
5.0 mg/m<sup>3</sup> or more
    - c) Laboratory accreditation under ISO/IEC 17025.
    - d) Claims of compliance for wet-applied products must state the amount applied in mass per surface area
  - 2) Complete "LEED Materials Documentation Sheet" with IEQc2 information for flooring systems installed within the waterproofing membrane.
- B. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
  1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, an amount equal to 25 square feet of floor mat for each color, finish and type installed.

#### 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Qualifications:
  1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  2. Do not deliver floor mat materials to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
  3. Deliver materials in original packages, containers or bundles bearing brand name, and identification of manufacturer or supplier.
- B. Storage and Handling Requirements:
  1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.

2. Store materials for 3 days prior to installation in area of installation to achieve temperature and humidity stability.
3. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
  - a. Store all mat materials under cover in dry, well-ventilated spaces as soon as delivered.
  - b. Protect floor matting from damage, dirt, stain, moisture, and mildew.

#### 1.9 SITE CONDITIONS

- A. Maintain a temperature of at least 60 degrees Fahrenheit, with a relative humidity of between 15 and 60 percent, for a period of 72 hours before, during, and 24 hours after installation.

#### 1.10 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manufacturer Warranty:
  1. Manufacturer's 10 year warranty which shall include texture retention, wear, and static protection and edge ravel resistance and run resistance strength for the life of the matting. Commencing on the date of substantial completion.
- C. Special Warranty: Mat installer's written guarantee covering prompt and proper replacement of any and all floor matting which indicates improper installation workmanship and/or defective material within twelve months from completion of the installation and acceptance thereof by the Architect, said corrective work being performed by the mat installer at no cost to the Owner.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  1. Floor mats:
    - a. Mats Inc., Stoughton MA.
    - b. Tek Stil Concepts Inc., Haddonfield NJ.
    - c. Pawling Corporation, Wassaic, NY.

#### 2.2 FLOOR MATS

- A. Walk-off Mat: To establish a standard of quality, design and performance desired, specifications have been based on a "Sisal Nop" appearance matting, manufactured by Mats Inc., Stoughton MA product "Supreme Nop", all weather polypropylene carpet matting with wafel rubber backing with., conforming to the following:
  1. Criteria:

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Manufacturing:	Needle felt.
Pile Fiber:	100 % UV stabilized polypropylene.
Pile (face) Weight:	33.9 ounces per square yard
Total Weight:	73 ounces per square yard
Primary Backing:	High density synthetic rubber
Roll Width:	6'-7"
Roll Width:	13'-2"
Color:	As selected by Architect from manufacturer's full available range.
Dye Method:	Solution dyed

### 2.3 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Shop-fabricate units of floor mats and grilles to greatest extent possible in sizes as indicated. Where not indicated otherwise, provide single unit for each mat installation, but do not exceed manufacturer's maximum size recommendation for units intended for removal and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints. Where possible, verify sizes by field measurement before shop fabrication.
- C. Fabricate frame to be truly straight, level and square. Provide frame pieces in longest available lengths to minimize joints. Space unavoidable joints evenly about centerline of mat and spline butt-joints with connecting pins. Form corners with tightly mitered joints or use prefabricated jointless corners.
- D. Provide frames and mats to sizes, shapes, and profiles indicated on approved shop drawings. Provide one-piece mats except where size exceeds manufacturer's recommended limit for easy removal and cleaning. Where more than one-piece mats are used, locate seams away from main traffic pattern.

### 2.4 FINISHES

- A. Finish coatings for aluminum to conform to Finish Designation system: AAMA 607.1.
  - 1. Exposed Aluminum Surfaces: (AA designation M12C22A41) Architectural Class I anodic coating, 0.7 mil thickness or greater, prepared with a mechanical M12, chemical C22 pre-treatment, clear anodized in color.

### 2.5 ACCESSORIES

- A. Adhesives for matting: NFPA Class A or UBC Class 1 types, as determined by ASTM E-84 Tunnel Test and as recommended by mat manufacturer.
- B. Filler for patching, smoothing and leveling substrate: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
  - 1. Ardex Americas, Aliquippa, PA. products "Feather Flash" and "Ardex SD-P".
  - 2. Quikrete Companies, product "Fast-Set Underlayment 1248".

3. Silpro Masonry Systems Inc., product "Profinish".
- C. Edging/nosing:
  1. Surface mounted application: Mats, Inc., 3/8 inch height heavy duty attached beveled nosing.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  1. Request correction of defects in receiving surfaces which are not correctable by the methods specified herein. Do not commence work until such defects are entirely corrected.
  2. Beginning of installation means acceptance of existing substrate and project conditions.

#### **3.2 PREPARATION**

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- B. Surface Preparation:
  1. Apply, trowel, and float filler to leave smooth, flat and hard surface, as required to ensure that floor mated surfaces will be level to within 1/8 inch tolerance in 10 feet in any direction.
  2. Prohibit traffic until filler is cured.
  3. Thoroughly sweep and vacuum all surfaces and remove all foreign matter.
- C. Unroll floor mat for adjustment to environmental conditions at least 24 hours prior to installation.

#### **3.3 INSTALLATION – FLOOR MATS**

- A. Apply adhesive and install entry mat in accordance with manufacturer's written instructions.
- B. Cement floor mat directly to the substrate with specified installation adhesive. Trowel adhesive evenly on the substrate. Install the floor mat within thirty minutes after spreading adhesive.
- C. Roll all floor mat areas with a 30 pound floor mat roller to ensure proper contact of floor mat with adhesive, and to remove all bubbles and buckles. Carefully roll seams and edges with the roller centered over the seam.



- D. Run all floor mat in the same direction. Plan and install floor mat in all areas so that single pieces per area shall be used to the fullest extent possible. No seams will be permitted in areas which are 12 feet, or less, in width.
- E. Carefully measure all cut-outs at the project.
- F. Make all seams in floor mating by back-cutting the floor mat [or mat] on an angle so that the face yarn of abutting pieces intermingles, and provides a practically invisible transition at each seam location. Center seams, occurring at door openings, parallel to, and directly under, the doors. Seams occurring at corridor change of direction shall follow wall line parallel to floor mat direction. Do not center seams, perpendicular to, in the path of travel to doors.
- G. Install specified edging wherever floor mating abuts a dissimilar flooring material, except where wood thresholds, or resilient floor tile trim occurs.

#### 3.4 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris, and scraps.
- B. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of adhesives and other materials installed under this Section.
- C. Clean work under provisions of Section 01 70 00 – EXECUTION.
  - 1. Clean and vacuum floor mat surfaces upon completion of the installation.
  - 2. HEPA vacuum floor mats immediately prior to Substantial Completion.

#### 3.5 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- B. Prohibit traffic from floor mat areas for 24 hours after installation.

End of Section

Section 14 10 00  
DUMBWAITER  
(ALTERNATE)

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. As part of Alternate Number 5, furnish and install: One electric overhead traction type dumbwaiter system, including the motor, car enclosures, hoistway entrances, equipment, support beams, guide rails, signal equipment, control systems, Electrical wiring, buffers, and all devices for operation, dispatching, safety, security, leveling, and alarms. This work includes:
  - 1. Removal and legal disposal of existing food service lift, including motor, guides, car, controls, and signal equipment.
  - 2. Perform complete prefinishing of all metal surfaces, except for bright metal work.
- B. Provide maintenance and call-back services for dumbwaiter equipment furnished hereunder.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 08 11 13 – Hollow Metal Doors and Frames: Furnishing and installing hoistway entrance doors and frames: .
- C. Section 09 29 00 - Gypsum Board: Gypsum board and metal frame construction at shaft-wall partitions and machine room: .
- D. Division 26 - ELECTRICAL:
  - 1. Temporary power supply
  - 2. Fused mainline switches or circuit breakers in the machine room, including feeders from the mainline switch to controllers or starters.
  - 3. 20-amp 120-volt single phase, one leg grounded, fused service knife switch in the machine room for the dumbwaiter signal equipment, including feeders from this switch to the dumbwaiter controller.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
1. ANSI/ASME A17.1-85 - American Standard Safety Code for Dumbwaiters, Dumbwaiters, Escalators, and Moving Walks
  2. ANSI/ASME A17.2 - Inspection of Dumbwaiters, Escalators, and Moving Walks.
  3. National Electrical Code.
  4. UL, Applicable requirements for motors, switches and other electrical components.
  5. All applicable federal, state and municipal codes, laws and regulations for dumbwaiters.
- B. Definitions:
1. All terms in this Section shall have meaning defined in the Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks, ANSI A17.1-85, including all revisions and modifications thereto. In all cases where a device or part of the equipment is herein referred to in the singular number, it is intended that such reference shall apply to as many such devices as are required to complete the installation.

## 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
1. Required attendees: Owner or designated representative, Architect, General Contractor, Dumbwaiter Installer's Project Superintendent, Dumbwaiter manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work.
  2. Agenda:
    - a. Scheduling of dumbwaiter installation operations.
    - b. Review of staging and material storage locations.
    - c. Coordination of work by other trades.
    - d. Installation procedures for ancillary equipment.

- e. Protection of completed Work.
  - f. Establish weather and working temperature conditions to which Architect and Contractor must agree.
  - g. Emergency rain protection procedure.
  - h. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.
- C. Sequencing:
- 1. Field Measurements
    - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
    - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
- D. Scheduling:
- 1. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows, or doors to place and install the work of this Section shall be performed at no additional cost to the Owner.

## 1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
- 1. Literature: Manufacturer's product data sheets, specifications, performance data, for dumbwaiter components furnished hereunder, including:
    - a. Signal and operating fixtures, operating panels, indicators.
    - b. Electrical characteristics and connection requirements.
  - 2. Manufacturer's warranties: Manufacturer's written warranty, countersigned by the installer, clearly stating all terms and conditions of the warranty, and covering all materials and workmanship provided hereunder for a period of not less than one year from date of Substantial Completion of the General Contract.
  - 3. Shop drawings: Large scale drawings indicating general arrangement for all dumbwaiter equipment; indicate on drawings:
    - a. Motor and controller selector, governor and other component locations.
    - b. Car, machine beams, guide rails, buffers, and other components in hoistway.
    - c. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
    - d. Individual weight of principal components; load reaction at points of support.
    - e. Loads on hoisting beams.
    - f. Landing heights.
  - 4. Sample chips of car finishes available, for initial selection by the Architect.

- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
  - 1. Parts list and wiring diagrams: Upon completion of the installation, submit four (4) copies of a complete parts list and as-built wiring diagrams for controller and dumbwaiter system.
  - 2. Provide technical and maintenance information for servicing operating equipment.
  - 3. Manufacturer's written installation warranty and maintenance contract herein below.
- C. The dumbwaiter shall be furnished and installed by a firm fully authorized by the dumbwaiter manufacturer; who is regularly engaged in the business of installing, and servicing dumbwaiters of the type specified herein.

#### 1.7 REGULATORY REQUIREMENTS

- A. General: Notify the Architect where conflicts apply between referenced standards, existing materials, and existing methods of construction.
- B. All designs, clearances, construction, workmanship, and material, unless specifically excepted, shall be in accordance with the requirements of ASME/ANSI A17.1-85 - Safety Code for Elevators and Escalators, and the New York State Elevator Code, as revised and amended per the rules and regulations of local authorities and all other governing bodies which may have jurisdiction.
- C. Products requiring electrical connection: Listed and classified by Underwriter's Laboratories, Inc., as suitable for the purpose specified and indicated.
- D. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of Dumbwaiters
- E. Qualifications:
  - 1. Manufacturers: Minimum of 7 years documented experience demonstrating previously successful work of the type specified herein
  - 2. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and authorized agent of dumbwaiter manufacturer.
  - 3. Welders Certificates: Utilize only qualified welders employed on the Work. Submit verification that Welder's are AWS D1.1 and D1.4 qualified within the previous 12 months.
  - 4. Professional Engineer Qualifications: Design structural elements under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of New York.

#### 1.8 PERMITS, TESTS AND INSPECTIONS

- A. Obtain and pay for all necessary municipal and State inspections and permits; make all tests as required by the regulations of such authorities.

1. In the event that the tested equipment does not meet all requirements of this Section, promptly remove from the premises all work determined by the Architect to be non-conforming. Promptly replace and re-execute the condemned work in accordance with the Contract Documents, bearing all expenses and costs therefore, including the costs of other trades as needed to restore related work destroyed or damaged by such removal and replacement work performed hereunder.
  - B. Obtain certificate of compliance from authority having jurisdiction indicating approval of installed dumbwaiter.
- 1.9 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:
    1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
  - B. Storage and Handling Requirements:
    1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
    2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
  - C. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.
    1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.
    2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
- 1.10 WARRANTY
- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
  - B. Manufacturer Warranty: In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.
  - C. Provide 1 year warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall include all materials and workmanship for the dumbwaiter system and its installation, countersigned by the dumbwaiter installer, clearly stating all terms and conditions of the guarantee, and covering all materials and workmanship provided hereunder for a period of not less than one (1) year from date of Substantial Completion of the General Contract.

1.11 MAINTENANCE

- A. Provide Installers maintenance contract under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, for a period equal to warranty. Maintenance contract shall include the following:
1. Emergency call back service during working hours.
  2. Semi-monthly examinations of the installation during regular working hours by trained employees of the dumbwaiter installer.
  3. All necessary adjusting, greasing, and oiling.
  4. Cleaning supplies and parts necessary to keep the equipment in proper operation, except any parts needed due to misuse, accident, or neglect caused by others.
- B. Repair work shall be carried out only by the dumbwaiter installer's personnel, using only standard parts furnished by the dumbwaiter manufacturer. Maintenance shall be carried out directly by the dumbwaiter installer and shall not be assigned or transferred to any agent.

**PART 2 - PRODUCTS**

2.1 MANUFACTURER AND TYPE

- A. Manufacture: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Matot, Inc., Bellwood IL.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Matot, Inc., Bellwood IL.
  2. All-Ways Elevator, Inc., Happaage, NY.
  3. Giant Lift Equipment Mfg. Co., North Hampton NH.
  4. Inclinator Company of America, Harrisburg, PH.
  5. Any cost incurred for changes in the work from that shown on the Drawings, including work of this and other Sections, due to the requirements of the particular equipment furnished hereunder is the sole responsibility of this Section 14 10 00 –DUMBWAITERS.
- C. General characteristics:
- |                        |                                    |
|------------------------|------------------------------------|
| Load (rated capacity): | 500 pounds.                        |
| Rated Speed:           | 50 feet per minute (single speed). |
| Operation:             | Single automatic call and send.    |
| Control:               | Wye delta starting.                |
| Rise:                  | As indicated on Drawings.          |
| Number of Stops:       | 2                                  |
| Landings:              | 2, 3.                              |
| Car Height             | 48 inches.                         |
| Car platform:          | 36 inches wide by 36 inches deep.  |
| Car door type:         | Bi-parting.                        |

Hoistway entrance: 36 inches wide by 48 inches high.  
Power supply: 208/230 volts, 3 phase, 60 hertz

## 2.2 EQUIPMENT

- A. Motor, controller, controls, buttons, wiring and devices, indicators shall be as required by ANSI/NFPA 70.
- B. Guide rails, ropes, counterweights, sheaves, spring buffers, attachment brackets and anchors shall be design for the purposed used and sized according to code with safety factors.

## 2.3 ELECTRICAL COMPONENTS

- A. Boxes, conduit, wiring, and devices shall be as required by ANSI/NFPA 70.
- B. Fittings: Steel compression type for electrical metallic tubing. Fittings with set screws are acceptable only when a separate grounding conductor is also installed across the joint.
- C. Include wiring and connections to dumbwaiter devices remote from hoistway and between dumbwaiter machine rooms. Provide additional components and wiring to suite machine room layout.

## 2.4 LUBRICATION:

- A. Lubrication: Suitable means shall be provided for lubrication with oil or grease, all bearing surfaces in connection with the dumbwaiter installation. Grease gun fittings, if used, shall be suitable for high pressure guns. Grease cups, if used, shall be automatic feed compression type.

## 2.5 HOISTWAY ENTRANCES:

- A. Hoistway entrances shall be complete with frames, doors, sills, miscellaneous hardware and related parts. Entrances shall carry U.L. for Class "B" 90 minute fire rating.
  - 1. Frames: Hollow metal construction of head jamb sections, fabricated from 16 gage sheet material. The jamb depth shall be determined by the specific partition thickness.
  - 2. Doors: hollow metal construction.
  - 3. Sills: Provide steel diamond plate with non-slip wearing surfaces.
- B. Hoistway door interlock: Equip each hoistway entrance door with a hoistway door interlock. The interlock shall prevent the operation of the dumbwaiter driving machine by the normal operating device unless hoistway doors are latched-closed position. The interlocks shall also prevent the opening of hoistway doors. Door interlock will permit opening of any single hoistway door when the car is stopped at same landing.

## 2.6 CAR ENCLOSURES:



- A. Car shell: The car shell walls and top, shall be fabricated from fire resistant treated 3/4 inch APA graded structural plywood, with interior sides finished with 18 gage stainless steel.
- B. Car floor: The car floor shall be fabricated of not less than 1-1/2 inch thick fire resistant, APA graded structural plywood and finished with 18 gage stainless steel.

2.7 HALL FIXTURES:

- A. Hall button features: One hall button fixture shall be provided per dumbwaiter per floor. with jeweled illuminated light indicated dumbwaiter in use, and call buttons Face plates for all hall fixtures shall be stainless steel.

2.8 FINISHES, GENERAL

- A. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent and prime two coats.
- B. Wood Surfaces not Exposed to View: One coat primer and one coat enamel.
- C. Backed Enamel on Steel: Clean and degrease metal surface; apply one coat of primer sprayed and baked; two coats of enamel sprayed and baked.
- D. Stainless Steel: Number 4 brushed finish.

**PART 3 - EXECUTION**

3.1 EXAMINATION

- A. Inspect all surfaces, and required embedded anchorage devices, and verify that they are in proper condition to receive the work of this Section. Verify dimensions indicated on approved shop drawings match existing conditions.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Arrange for temporary electrical power for installation work and testing of dumbwaiter components.

3.3 INSTALLATION

- A. Install in accordance with the approved shop drawings and the manufacturer's written instructions, ANSI/ASME A17.1 and those standards required by authority having jurisdiction, and with the additional requirements specified herein.
- B. Furnish and install all internal and operational wiring, conforming to the requirements of the National Electrical Code, as necessary to connect the operating buttons and switches, from the control board to the power unit. Except for short lengths of flexible conduit to moving apparatus, ensure that all wiring is contained in rigid conduit or electrical metal tubing.

- C. Mount motor on vibration and acoustic isolators. Place unit on structural supports and bearing plates. Securely fasten to building supports. Prevent lateral displacement.
- D. Accurately machine and align guide rails. Form smooth joints with machine splice plates. Install guide rails plumb and parallel to each other within 1/8 inch. Install using threaded bolts with metal shims and lock washers under nuts, provide compensation for expansion and contraction movement.
- E. Bolt or weld brackets directly to existing hoistway framing. Chip and clean field welds of oxidation and residue, wire brush and spot prime with two coats of primer.

#### 3.4 ADJUSTING

- A. Adjust for smooth acceleration and deceleration of car. Adjust automatic levelling feature at each landing to within 1/8 inch from flush.

#### 3.5 CLEANING

- A. Clean work under provisions of Section 01 70 00 – EXECUTION.
- B. After all work under this Section has been completed and satisfactorily tested, remove all applied packing labels from the various surfaces, thoroughly clean all prefinished surfaces and polish stainless steel surfaces. Touch up all scratches, abrasions, and other surface defects in the prefinished surfaces, using the same material, color, and gloss as used in the prefinishing system.
- C. Upon completion of the work of this Section, remove tools and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

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SECTION 14 21 00

TRACTION ELEVATORS

**PART 1 – GENERAL**

1.1 DESCRIPTION

- A. Work included: Provide materials, labor, and services necessary for complete safe, installation of four (4) traction elevators, numbers: 1-4 as shown and specified.
- B. Related work specified elsewhere:  
NOTE: THE WORK SPECIFIED PERTAINS TO ALL ELEVATORS UNLESS OTHERWISE NOTED.
1. Section 01 50 00 - Protecting Installed Construction: Temporary use of elevators.
  2. Section 05 50 00 - Metal Fabrications: Sill support angles, hoisting beams, divider beams, intermediate rail supports, and pit ladders.
  3. Section 05 57 00 - Ornamental Metal
  4. Section 09 30 00 Tiling
  5. Construction of hoistways, pits, machine rooms, locations that require access and access ladders or required structures.
  6. Hoistway, machine room and mechanical space ventilation, cooling and heating.
  7. Electrical work and lighting of pits, hoistways, machine rooms and mechanical spaces. Hoistway illumination, provide a 4-foot, LED vapor-tight fixture with molded, high-impact clear acrylic diffuser installed above the highest landing entrance and at the MRL machine equipment location to provide substantial illumination to maintenance personnel working in these areas. Pit illumination, provide two 4-foot LED vapor-tight light fixtures installed in the pit. Locate to provide illumination of all elevator pit equipment.
  8. Supports for guide rail brackets, machinery and equipment, buffers and entrance installation.
  9. Electric feeders to disconnect switches or circuit breakers to elevator starter or control panels.
  10. Interface of elevators to building Fire Alarm system and emergency power system.
  11. Conduit to remote locations for elevator intercommunication and alarm systems.
  12. Indicated or required chases and openings.
  13. Finish painting except as noted.
  14. Guarding and protecting hoistway during construction.
  15. Storage space for tools and materials.
  16. Electric power for testing and adjusting equipment.
  17. Telephone and security system interface wiring to control panels.
  18. Sump pits, sump pump and associated devices and removable gratings.
  19. Grouting and sealing of entrances, fixtures and entrance sills.
  20. Access to underside of elevator and buffer ladders and gratings.
  21. Rope sleeves in walls, floors or concrete work.
  22. Provide all required Independent Third Party Elevator Inspections.

1.2 REFERENCES

- A. Applicable Codes (Latest Edition):
1. American National Standard, Safety Code for Elevators and Escalators (ANSI/ASME A17.1).

2. International Building Code (IBC)
3. American Disabilities Act - ADAAG published in Federal Register July 26, 1991.
4. American National Standard Specification for Making Buildings and Facilities Accessible to and Usable By Physically Handicapped People (ANSI A117.1).
5. Authorities having jurisdiction.

### 1.3 DEFINITIONS

- A. The following definitions apply to work of this Section:
1. "Provide": to furnish and install, complete for safe operation, unless specifically indicated otherwise.
  2. "Install": to erect, mount and connect complete with related accessories.
  3. "Supply": to purchase, procure, acquire and deliver complete with related accessories.
  4. "Work": labor and materials required for proper and complete installation.
  5. "Wiring": raceway, fittings, wire, boxes, and related items.
  6. "Concealed": embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces or in enclosures.
  7. "Exposed": not installed underground or "concealed" as defined above.
  8. "Indicated", "shown", or "noted": as indicated, shown or noted on Drawings or as specified.
  9. "Similar", or "equal": of base bid manufacturer, equal in materials, weight, size, design and efficiency of specified product, conforming to "Acceptable manufacturers."
  10. "Reviewed", "satisfactory", "accepted", or "directed": as reviewed, satisfactory, accepted or directed, by or to Owner.

### 1.4 OPERATION PERFORMANCE

- A. The control system shall provide smooth acceleration and deceleration with 1/8" leveling accuracy at all landings, from no load to full rated load in the elevator, under normal or unloading conditions. The self-leveling shall, within its zone, be entirely automatic and independent of the operating device and shall correct for overtravel and undertravel. The car shall remain at the landing irrespective of load. Clearance between the car sill and the hoistway landing shall not exceed 1 1/4" inch.
- B. The floor-to-floor performance time under the above criteria shall be 10.0 seconds for the elevators (floor-to-floor time is measured from the start of door close at one floor to 3/4 open at the next floor).
- C. The door open time for the elevators shall be 2.5 seconds from start of door open to fully open for 42" side slide doors.
- D. The door close time shall be based on the Code requirements with a door delay feature. The door delay is the minimum acceptable time from notification that a car is answering a call (lantern and audible signal) until the doors of the car start to close. Time shall be calculated by the following equation:
1.  $T = D/(1.5\text{ft/s})$
  2. T = Total time in seconds.
  3. D = Distance from a point in the lobby 60 inches directly in front of the hall station to the centerline of the door opening.

- 4. For elevators with in car lanterns, T begins when the lantern is visible from the vicinity of the hall call station and the audible signal is sounded.
  - E. Car Call: The minimum acceptable time for doors to remain fully open shall not be less than 5 seconds.
  - F. The speed of the elevator shall not vary +/- 5% under loading conditions.
  - G. Prior to final acceptance and prior to the termination of the maintenance period, the elevators shall be adjusted as required to meet these performance requirements.
- 1.5 SUBMITTALS
- A. Submittals shall comply with the requirements of the Construction Contract Clauses, Division 1 Section "Submittals" and the individual sections specifying the work.
  - B. Provide a standard submittal register that identifies all items scheduled for submittal and required by this section. Arrange register by specification section and item number for project tracking and coordination. Contractor should provide a submittal package with tabs or notes that clearly identify the information provided where it is located and whether that information has been modified and/or updated since the previous submissions in order to expedite the review process and to encourage a collaborative effort.
  - C. Shop Drawings: Submit fully dimensioned layouts specific to this project, bearing the Professional Engineer's Stamp of a PE licensed in the state of this project, in plans, sections and elevations and details of the machine room equipment, car enclosures and hoistway entrances. Prepare elevator sections to show service to each level. Clearly identify all equipment for each elevator. Include the following items on drawings along with detailed dimensions.
    - 1. Location of the traction machine, controller, Solid State Motor Drive unit, isolation transformer, choke coil, governor and other components located in the machine room.
    - 2. Elevator car, frame and platform, counterweight, sheaves, supporting beams, guide rails, buffers and other components located in the hoistway.
    - 3. Weights of components.
    - 4. Reactions at support points.
    - 5. Maximum vertical and horizontal forces on guide rails.
    - 6. Top and bottom clearance and overtravel of car and counterweight.
    - 7. Location of fused, externally operable mainline disconnect switch and shunt-trip circuit breaker (CB) without overcurrent trip, light switches, hands free communication, communication with elevator car device and feeder termination at controller.
    - 8. Location of outlets for connection of traveling cables for car lights and telephone in elevator machine room or hoistway.
    - 9. Location of hoistway access switches.
    - 10. Names of manufacturer, type or style designation of all components provided.
    - 11. Cuts or drawings showing details of hoistway access switches.
    - 12. Provide reference drawings for approval showing details of intended mounting brackets and mounting methods for all new devices (tachometers, rope grippers, etc.) to be attached to existing elevator machines or other existing elevator equipment.
    - 13. Controller, Transformer and Choke Locations:
    - 14. Provide the following drawings for approval:

- a. Complete drawings of cab, showing details of construction and/or alteration and the location of car equipment.
  - b. Complete drawings of custom signal and control fixtures, showing all switches, push buttons lights, signage and all other components of each signal or control fixture and operating device.
  - c. Corridor elevations, showing the location of each corridor fixture in relation to the hoistway entrance frames and the finished floor.
  - d. Other drawings, as required, requested or specified within the document.
- D. The manufacturer's name, type or style designation, and the information listed below shall be included on the shop drawings for each elevator. In addition, submit the manufacturer's catalog data for approval.
1. Solid state drive set and Watt emission
  2. Hoist machine.
  3. Microprocessor based controller.
  4. Landing control device.
  5. Governor.
  6. Unintended Movement of Car Device, including mounting details.
  7. Power door operator assembly.
  8. Hoistway door interlocks and electrical contacts.
  9. Buffers including stroke, piston diameter, certified maximum and minimum loads and maximum striking speeds.
  10. Firefighters' Emergency Operation.
  11. Isolation transformer chokes, etc.
  12. CRT monitor, printer, and/or service tool.
  13. Signal fixtures, corridor and car operating stations, main floor elevator lobby panel and/or firefighters' service panel.
  14. Door protective device.
- E. Calculations:
1. Submit the following calculations and data signed and sealed by the qualified professional engineer registered in the jurisdiction responsible for its preparation, as applicable to the equipment involved, within three (3) weeks of Notice to Proceed:
  2. Machine room equipment BTU output.
  3. Power supply data sheets, indicating equipment power demand; main line fuse and auxiliary circuit breaker or fuse sizes; and other pertinent electrical data, relative to the elevators.
- F. Certificates shall be submitted for:
1. Interlocks and contacts.
  2. Protection pads (If provided under this Contract).
  3. Governors.
  4. Buffers.
- G. Equipment Brochure and Service Manuals:
1. Before acceptance of work, furnish three sets of manufacturer's equipment brochures and service manuals. Assemble manuals in chronological order according to the specification alphanumeric system. Provide manufacturer's standard binders consisting of:
    - a. Equipment and components, descriptive literature.
    - b. Performance data, model number.
    - c. Installation instructions.

- d. Operating instructions.
  - e. Maintenance and repair instructions.
  - f. Spare parts lists and current price list.
  - g. Lubrication instructions.
  - h. Detailed, record and as-built layout drawings.
  - i. Detailed, simplified, one line, wiring diagrams. Provide one complete set per manual.
  - j. Field test reports.
  - k. Complete set of contract software.
- H. Machine Room Prints: Provide three complete sets of "as- built" field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway as well as the machine room. One set of these diagrams shall be protected and mounted the elevator machine room as directed.
- I. Provide one set of all submittals, shop drawings, wiring diagrams and manuals in electronic format for long term document storage.
- J. Submit documentation that materials comply with LEED requirements referenced.
- K. Maintenance Control Program (MCP): Provide MCP specifically designed for the equipment included under this contract. Include any unique or product specific procedures or methods required to inspect or test the equipment. In addition, identify weekly, bi-weekly, monthly, quarterly, and annual maintenance procedures, including statutory and other required equipment tests.
- L. Contractor must provide at minimum, four (4) copies of each key installed for all key switches installed in the car operating panel, including floor lockouts, fire service, independent, access, run/stop, fan/light, control cabinet access, etc. Keys must be turned over to the Cornell VCOM office.

#### 1.6 QUALITY ASSURANCE

- A. Quality and gauges of materials:
- 1. New, best of their respective kinds, free from defects.
  - 2. Materials, equipment of similar application; same manufacturer, except as noted.
  - 3. Gauges as noted.

#### 1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship in original crated sections of a size to permit passage through available space.
- B. Obtain approval and schedule delivery of material to meet Owner's requirements.
- C. Storage of equipment and materials shall be coordinated with Owner.

#### 1.8 WARRANTY

- A. The elevators and associated equipment shall be free of defective material, imperfect work and faulty operation not due to ordinary wear and tear or improper use or care, for a period of one year from final acceptance of each elevator. Defective work shall be repaired or replaced at no additional cost to the Owner.



- B. Special Manufacturer's Warranty shall be a written warranty, signed by manufacturer/elevator installer agreeing to maintain, repair, restore or replace defective materials and workmanship of elevator work for the entire warranty period. In addition, warranty period shall re-start for any defects or workmanship items which develop within original warranty period as noted later in this Section.
- C. Minimum warranty period shall be 365 days from agreed upon start date, with extensions as needed to cover items or systems found defective during the warranty period. Start date is when the elevator system has been fully constructed and passed all acceptance testing without any violations or unaccepted items; substantial completion is not when the warranty starts. Warranty start date must be agreed upon between the installation contractor, Cornell project management and the Cornell VCOM office and documented in writing on the warranty. If the elevator system has completed all requirements and approved for public use, but the building is still under construction and the elevator is not yet in use, then the elevator system warranty will be delayed until the building has been turned over to Cornell for beneficial use including full elevator service.
- D. Warranty shall include full service maintenance and 24-hour callback service upon completion of the installation. This service shall include regular monthly examinations. Provide a minimum of twelve (12) full maintenance inspections at least once per month during the 365-day warranty period. Inspections shall include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning and all adjustments required for proper system operation at the rated capacity and speed. Provide supplies and parts that are the same as those used in the manufacture and installation of the original equipment. In the event the twelve (12) site visitations are not completed, the elevator contractor will extend his warranty covering all callbacks, repairs, parts, testing, labor and any other items necessary to keep the elevator in like new condition until the twelve (12) warranty site visitations have been completed. Service shall be provided during regular working hours, performed by the installers, and not by any other service agency.
- E. Any elevator controller requiring major repair or replacement within the warranty period due to any reoccurring problems resulting from faulty original design or installation shall cause the original warranty to be extended 12 full months from the date of correction. This includes major circuit boards, power supplies, etc.

#### 1.9 MAINTENANCE SERVICE

- A. Temporary Interim Service: When elevators have been installed to a stage near completion and declared ready for service prior to completion and final acceptance of complete elevator system (start of maintenance and warranty periods), Owner may accept elevators for building use on interim basis.
  - 1. During period prior to final acceptance, General Contractor will pay mutually agreed amount for each day for each unit for maintenance of elevators accepted for interim use.
  - 2. During interim service period, user shall provide protection of cabs, entrances, and fixture to prevent damage.
- B. Initial Full Maintenance Service: Provide initial 12 month maintenance service during warranty period, by trained mechanics. Maintenance shall commence upon completion and acceptance of all elevator work and shall include examination, adjustment, greasing, oiling, parts replacement due to normal use. Provide 24 hour emergency call back service at no additional charge. Callback service and response time during the warranty

period shall include:

1. 24-hour-per-day, 7-day-per-week callback service
2. General Service Response Time: Two hours or less to be onsite
3. Entrapments Response Time: One hour or less to be onsite

C. Maintenance Responsibility

1. The Contractor shall keep the elevator maintained to operate at the original contract speed, keeping the original performance times, including acceleration and retardation as designed and installed by the manufacturer. The door operation shall be adjusted as required to maintain the original door opening and door closing times, within legal limits.
2. The Owner reserves the right to make inspections and tests as and when deemed advisable. If it is found that the elevator and associated equipment are deficient either electrically or mechanically, the Contractor will be notified of these deficiencies in writing, and it shall be his responsibility to make corrections within 30 days after his receipt of such notice. In the event that the deficiencies have not been corrected within 30 days, the Owner may terminate the contract and employ a Contractor to make the corrections at the original bidder's expense.
3. Approximately one month prior to warranty expiration, Cornell VCOM will contact the installation contractor to schedule a final turnover inspection and test. The elevator contractor is responsible to perform all required inspections and tests witnessed by a third-party inspector. The inspector will submit reports to the Cornell VCOM office. The Cornell Project Manager will be notified of any violations and is required to remediate all violations prior to end of warranty.

D. Maintenance records shall be written and document compliance with ASME A17.1 Section 8.6 including maintenance control program and shall be turned over to Cornell at the conclusion of the warranty period.

E. Diagnostic Tools and Spare Parts: At the completion of the work as specified, the Contractor shall provide items listed. The items shall become the Owner's property.

1. One complete set of all diagnostic tools and equipment required for the complete maintenance of all aspects of the control and dispatch system and solid-state motor drive units. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the serviceman and the controls. All such systems shall be free from secret codes and decaying circuits that must be periodically reprogrammed by the manufacturer. Diagnostic equipment shall be permanently mounted in the control cabinet. Use of removable or portable diagnostic systems is unacceptable. Owner shall not be required to enter in a contract or lease agreement to obtain any service tool or instrument.
2. A list of vendors for all parts used in the installation.

F. Service shall include all necessary labor, adjustments, greasing, oiling, cleaning, supplies and parts to keep the equipment in proper operation, except parts made necessary by misuse, accidents or neglect caused by others. Installation contractor shall provide written record of work performed signed by a Cornell representative after each visit. Advise the Cornell VCOM office each time before and after completion of service.

F. Cornell University and its elevator maintenance contractor reserve the right to respond to any elevator emergency. In an event that someone is trapped in a stalled elevator that is under warranty, Cornell through its contracted maintenance provider may respond to free passengers as soon as possible to insure passenger safety. The contracted maintenance

provider may need to remove covers, open doors, operate equipment, etc. during an emergency. Any of this work shall only be performed by qualified elevator mechanics and as a last resort to insure safety.

#### 1.10 CLOSEOUT AND ACCVEPTANCE DOCUMENTS

- A. Acceptance certificate to operate each elevator system shall be issued by a QEI certified third-party elevator inspection company. Certificate must be an original signed version.
- B. Inspection and Testing Report in compliance with all ASME A17.1 requirements for Elevators shall be issued by a QEI certified third-party elevator inspection company. Inspection report shall clearly identify any violations. Installation contractor shall provide additional written documentation clearly identifying remediation repairs clearing all inspection violations. All documentation must be an original signed version.
- C. Hydraulic elevator systems, installation contractor shall provide an accurate volume of all hydraulic fluid installed in system including all piping and storage vessels. Report all data in gallons and half gallons. Provide manufacturer, model and specifications of fluid installed in the system.
- D. Traction elevator systems: provide written documentation describing installed hoist rope specifications, length installed and all rope tensioning data.
- E. All documentation shall be in original form and signed by all required inspection personnel and the project management representative as needed and turned over to Cornell VCOM.
- F. Provide copies of all installation shop drawings of the elevator systems installed.
- G. Provide detailed system data such as capacity, speed, motor HP, distance of travel, safety edge, etc.
- H. Provide a complete set of wiring diagrams indicating any modifications to the elevator controller required by the installation of a battery-lowering device system.
- I. Provide the written procedures to test, service and repair the battery-lowering device. A copy shall be located in the elevator machine room.

#### 1.11 ELECTRIC SERVICE

- A. Power: 480 volts, 3 phase, 60 hertz. Elevator Contractor to verify.
- B. Lighting: 120 volts, 1 phase, 60 hertz.

#### 1.12 MATERIALS

- A. Fire Resistance: Treat wood components with fire-retardant treatment conforming to requirements of authorities having jurisdiction and to achieve flame spread rating of 25, ASTM E84.
  - 1. Protect electric wiring with flame retardant and moisture resistant outer covering, run in conduit, tubing or electrical wire ways.

- B. Non-Shrink Grout: Pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 4000 PSI at 28 days.
- C. Factory Primers and Paints:
  - 1. Primer for steel surfaces: Rust inhibitive, alkyd type.
  - 2. Primer for galvanized surfaces: Zinc chromate, alkyd type.
  - 3. Primer for wood surfaces: Alkyd primer/sealer.
  - 4. Finish paint for metal surfaces: Alkyd type, semi-gloss, enamel.
  - 5. Finish paint for wood surfaces: Alkyd type, semi-gloss, enamel.
- D. Sheet Steel: Cold rolled, commercial quality, Class I, stretcher- leveled, matte finish, ASTM B366.
- E. Satin Bronze:
  - 1. Sheet: UNS S30200/S30400, ASTM A240.
  - 2. Tubes: ASTM A269.
  - 3. Reveals and Trim: Minimum 16 gage, ASTM A276.
  - 4. Bars and Shapes: ASTM A276.
  - 5. Castings: ASTM A297, iron-chromium-nickel.
  - 6. Bronze materials shall be constructed of stretcher-leveled sheets with 60 percent copper and 40 percent zinc that are similar to Muntz Metal, Alloy Group #2. After cleaning, spray with one coat of clear lacquer.
- F. Extruded Aluminum: Alloy 6063-T6, ASTM B221.
- G. Wood:
  - 1. Panels: Minimum ¾" thick with particleboard or MDF cores, fire retardant treated. Provide anti-warp backing, registered with local authority having jurisdiction, for elevator finish materials.
  - 2. Fire Retardant Treatment: Comply with applicable code requirements and AWWA Standards for pressure impregnation with fire retardant chemicals to achieve a flame spread rating of 25 or less (Class A), ASTM E84.
  - 3. See architectural finish schedule and drawings for panel design and wood veneer types.
  - 4. Provide components that fully comply with all project LEED requirements.
- H. Stone: Furnished and installed as part of other trades.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Product of individuals, firms or corporations regularly engaged in manufacturing elevators comparable with this contract and in satisfactory operation for a period of not less than five years.
- B. Qualified Bidders:
  - 1. ThyssenKrupp Elevator Company
  - 2. KONE Elevator Company
  - 3. Otis Elevator Company
  - 4. Schindler Elevator Company

5. Independent Manufacturers and Installers of equipment Approved by Owner or Owner's Representative as Equal.

## 2.2 OUTLINE OF EQUIPMENT

- A. Elevator Number: 1
1. Elevator Use: Passenger/Service
  2. Contract Load, in Pounds: 3,500 lbs.
  3. Contract Speed: 200 fpm
  4. Travel Distance: As shown on drawings.
  5. Landings: 1\*, 2-5
  6. Number of Stops: Five (5)
  7. Number of Openings: 5 front
  8. Machine Location: Overhead
  9. Machine Type: Machine Room Less (MRL) type  
Gearless
  10. Type of Control: AC variable frequency
  11. Operation: Simplex
  12. Main Fire Floor: 1\*
  13. Alternate Fire Floor: 2
  14. Car and Hoistway Door Size: 3' 6" wide by 7' 0" high
  15. Car and Hoistway Door Type: Two Speed Side Slide opening
  16. Car and Hoistway Door Operator: Power, High-speed, heavy duty  
(minimum opening speed 2.5 FPS) closed loop operation.
  17. Hoistway Entrance: As specified.
  18. Cab Enclosure: As specified.
  19. Door-reversal Device: Electronic entrance detectors.
  20. Car Operating Panel: As specified.
  21. Car Position Indicator: As specified.
  22. Car Direction Indicator: As specified.
  23. Hall Call Stations: One riser.
  24. Hall Position Indicator: As specified.
  25. Building Lobby Control Panel: As specified.
  26. Fire Room Control Panel: As specified.
  27. Machine Room Monitor: As specified.
  28. Load Weighing Device: As specified.
  29. Communication System: ADA, Hands Free Type Telephone
  30. Security Features: As specified.
- B. Elevator Number(s): 2
1. Elevator Use: Service
  2. Contract Load, in Pounds: 3,500 lbs.
  3. Contract Speed: 200 fpm
  4. Travel Distance: As shown on drawings.
  5. Landings: 3\*, 3R, 4-6
  6. Number of Stops: Five (5)
  7. Number of Openings: 4 front, 1 rear
  8. Machine Location: Overhead
  9. Machine Type: Machine Room Less (MRL) type  
Gearless
  10. Type of Control: AC variable frequency
  11. Operation: Simplex
  12. Main Fire Floor: 2\*

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13.	Alternate Fire Floor:	3
14.	Car and Hoistway Door Size:	3' 6" wide by 7' 0" high
15.	Car and Hoistway Door Type:	Two speed side slide
16.	Car and Hoistway Door Operator:	Power, High-speed, heavy duty (minimum opening speed 2.5 FPS) closed loop operation.
17.	Hoistway Entrance:	As specified.
18.	Cab Enclosure:	As specified.
19.	Door-reversal Device:	Electronic entrance detectors.
20.	Car Operating Panel:	As specified.
21.	Car Position Indicator:	As specified.
22.	Car Direction Indicator:	As specified.
23.	Hall Call Stations:	One riser.
24.	Hall Position Indicator:	As specified.
25.	Building Lobby Control Panel:	As specified.
26.	Fire Room Control Panel:	As specified.
27.	Machine Room Monitor:	As specified.
28.	Load Weighing Device:	As specified.
29.	Communication System:	ADA, Hands Free Type Telephone
30.	Security Features:	As specified.
C.	Elevator Number(s):	3
1.	Elevator Use:	Service
2.	Contract Load, in Pounds:	3,500 lbs.
3.	Contract Speed:	200 fpm
4.	Travel Distance:	As shown on drawings.
5.	Landings:	2*, 3, 3R, 4R, 5R
6.	Number of Stops:	Five (5)
7.	Number of Openings:	2 front, 3 rear
8.	Machine Location:	Overhead
9.	Machine Type:	Machine Room Less (MRL) type Gearless
10.	Type of Control:	AC variable frequency
11.	Operation:	Simplex
12.	Main Fire Floor:	2*
13.	Alternate Fire Floor:	3
14.	Car and Hoistway Door Size:	3' 6" wide by 7' 0" high
15.	Car and Hoistway Door Type:	Two speed side slide
16.	Car and Hoistway Door Operator:	Power, High-speed, heavy duty (minimum opening speed 2.5 FPS) closed loop operation.
17.	Hoistway Entrance:	As specified.
18.	Cab Enclosure:	As specified.
19.	Door-reversal Device:	Electronic entrance detectors.
20.	Car Operating Panel:	As specified.
21.	Car Position Indicator:	As specified.
22.	Car Direction Indicator:	As specified.
23.	Hall Call Stations:	One riser.
24.	Hall Position Indicator:	As specified.
25.	Building Lobby Control Panel:	As specified.
26.	Fire Room Control Panel:	As specified.
27.	Machine Room Monitor:	As specified.
28.	Load Weighing Device:	As specified.
29.	Communication System:	ADA, Hands Free Type Telephone
30.	Security Features:	As specified.

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D.	Elevator Number:	4
1.	Elevator Use:	Service
2.	Contract Load, in Pounds:	3,500 lbs.
3.	Contract Speed:	200 fpm
4.	Travel Distance:	As shown on drawings.
5.	Landings:	3*, 4 - 6
6.	Number of Stops:	Four (4)
7.	Number of Openings:	4 front
8.	Machine Location:	Overhead
9.	Machine Type:	Machine Room Less (MRL) type Gearless
10.	Type of Control:	AC variable frequency
11.	Operation:	Simplex
12.	Main Fire Floor:	2*
13.	Alternate Fire Floor:	3
14.	Car and Hoistway Door Size:	3' 6" wide by 7' 0" high
15.	Car and Hoistway Door Type:	Two speed side slide
16.	Car and Hoistway Door Operator:	Power, High-speed, heavy duty (minimum opening speed 2.5 FPS) closed loop operation.
17.	Hoistway Entrance:	As specified.
18.	Cab Enclosure:	As specified.
19.	Door-reversal Device:	Electronic entrance detectors.
20.	Car Operating Panel:	As specified.
21.	Car Position Indicator:	As specified.
22.	Car Direction Indicator:	As specified.
23.	Hall Call Stations:	One riser.
24.	Hall Position Indicator:	As specified.
25.	Building Lobby Control Panel:	As specified.
26.	Fire Room Control Panel:	As specified.
27.	Machine Room Monitor:	As specified.
28.	Load Weighing Device:	As specified.
29.	Communication System:	ADA, Hands Free Type Telephone
30.	Security Features:	As specified.

### 2.3 MACHINE ROOM EQUIPMENT

- A. Provide equipment to fit space conditions shown. Provide an elevator drive machine from a manufacturer that provides comprehensive factory training and technical support for installation, adjustment, service, and maintenance of the drive system. The training and support must be identified as available to any licensed elevator contractor. Provide verification of an established and documented training schedule, with pricing, for factory training classes that have been provided for a minimum period of one year prior to contract award date. The elevator drive system must be identified as available for purchase and installation by any licensed elevator contractor. All drive system related components, parts, diagnostic tools, and software must be available for purchase, installation, and use by any licensed elevator contractor; "exchange-only" provisions for the purchase of spare parts are not acceptable. Provide verification of telephone and internet based technical support service that the elevator controller manufacturer provides to any licensed elevator installation, service, and maintenance company at an industry competitive price. The service must include live telephone based technical support for installation, adjustment, maintenance, and troubleshooting of the elevator

controller and related elevator components. The service must be available during standard working hours.

- B. Machine Room Less (MRL) Type Geared or Gearless traction: Geared or gearless traction type equipment that utilizes a common shaft with motor, brake, bearings, drip pans, sheaves and bedplate. Machine shall have anti-friction metal sleeve, base or roller type bearings. Drive sheaves shall be manufactured from hard alloy cast iron or steel with adequate thickness for future grooving. Use of suspension means other than steel wire rope is unacceptable. Basis of Design: Hollister Whitney: GL-170

Provide equipment to fit space conditions shown. The clear hoistway dimensions shown on the drawings should be considered fixed. If the requirements of the proposed MRL equipment exceed these limits, include clarification of dimensional requirements in the initial cost proposal so that feasibility can be confirmed. Contractors are responsible for any and all changes and/or modifications to the building structure, machine room and mechanical spaces, hoistways, pits, electrical requirements, mechanical requirements and access requirements are required to facilitate the use of their specific MRL technology. Machine and associated devices shall be provided with equipment and necessary components to prevent ascending car overspeed and unintended car movement in accordance with code requirements.

- C. Motors: The hoisting motor shall be Alternating current type and designed to develop high starting torque with low starting current.
- D. Power Conversion and Regulation Unit: Solid state units shall be designed to limit current, suppress airborne or structural noise, and shall limit the overall distortion factor at the point of connection of the elevator convertor feeders to the electrical distribution system to a maximum of 3 percent. This shall include compensation for harmonic distortion, power factor, flicker and line notching. The elevator contractor shall be responsible for furnishing any electrical changes or upgrades required if power conversion system other than specified is provided. All solid states drive shall be designed for regenerative current type use.
- E. Isolation Transformer: Provide necessary isolation transformers, reactors, capacitors and other devices to limit the overall Distortion Factor at the point of connection of the elevator converter feeders to the electrical distribution system to a maximum of 3 percent. This shall include compensation for the following:
1. Harmonic Distortion
  2. Power Factor
  3. Flicker
  4. Line Notching
- F. Controller: Provide enclosed controller panels with ventilated cabinets and hinged or removable doors. Provide permanently marked symbols or letters identical to those on wiring diagrams adjacent to each component. Provide required ASME labeling and certification.
- G. Selectors: Solid state or moving crosshead type electrically or mechanically coupled to car. Encoder: Provide solid-state, optical, digital-count type, mechanically coupled to car via a slotted tape with drive sheaves and a pit-tensioning sheave or driven from the car governor. Optical, inductive pulse or mechanical target-type tape encoder mounted in the hoistway is acceptable.
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- H. Machine Beams and Structural Supports: Provide steel beams, channels and bearing plates to support machine, governors and rope hitches. Include any required clip angles, tie rods, etc. as required.
- I. Foundation bolts and templates: Provide template, foundation bolts and hardware for foundation mounting.
- J. Deflector Sheaves: Provide steel machined and grooved for diameter of ropes and supported by an "A Frame" type mounting. Provide cable guards designed to withstand shock and prevent ropes from leaving their proper grooves. All bearings are to be shielded or sealed.
- K. Sleeves and Guards: Provide sleeves projecting 4" above concrete slabs for holes in machine room floor. Provide guards for sheaves, ropes and selector tape.
- L. Provide a fire extinguisher in machine room per code requirements.

## 2.4 OPERATING SYSTEMS

- A. Dispatching and Group Supervisory System:
  - 1. Provide a closed loop, solid state microprocessor dispatch system which shall provide for continuously changing operations in various traffic situations, and efficiently handle the varying passenger traffic demands:
    - a. It shall provide for a continuously changing program of varying combinations when there are landing calls registered. These shall include components of incoming, outgoing, interfloor and special traffic in varying intensities.
    - b. The main floor up call is to be given priority.
    - c. The system shall have forecasting capabilities which will assign the desired degree of priority to any additional entrance floor.
    - d. The system shall measure the call waiting times on all floors, and determine through forecasting whether the elevator on becoming vacant shall continue in the previous running direction or reverse and assist in concentrated interfloor traffic in specific areas of the building.
    - e. The system shall constantly evaluate the service quality of all forecasted waiting times. The landing calls will be allocated by the process of optimization with no final assignment established until the total quality of passenger service is assessed.
    - f. A light traffic mode is assumed when there are no registered landing calls within a preset time. During periods of traffic, elevators shall be parked in anticipation of new landing calls. At least one elevator is to be parked at the main floor. Other elevators can be parked at upper or lower floors, as previously stated. The elevators shall be parked with the doors closed. The need for parking shall be checked by the system at frequent intervals.
    - g. With the increasing traffic intensity, a priority method of call assignments shall be initiated. Priority of service for landing calls is determined by the call waiting time in relation to the prevailing traffic condition. The system shall prevent waiting times that are excessive as compared to the traffic intensity.
      - 1. Peak type of demands shall be recognized by monitoring the total traffic flow including a predominance of car calls in one direction, a high intensity of landing calls in one direction, a

- sudden high percentage of load increase when answering landing calls, main floor landing hall call intensities and departure of elevators from a designated floor with a predetermined load several times in a preset time.
2. When an up peak type of demand is recognized, the main floor up call is immediately classified as priority call. The first vacant elevator is always dispatched to the main floor, the dispatch of another vacant elevator to the main floor is subject to optimization by the computer and decisions depending on the degree of up intensity and the amount of traffic flow against main flow. When passengers enter the elevator, the elevator can start as the first car call has been registered. The doors shall, however, stay open as long as further passengers are detected entering the elevator. Once the car call has been registered, the control system shall dispatch another vacant elevator to the main floor, unless a vacant elevator is already there.
  3. With an up peak traffic type of operation, the main traffic flow (incoming traffic) shall receive preferential service. The system shall continuously re-evaluate the traffic pattern and adjust the group operation. If it detects a sudden simultaneous intensive down demand, it shall cancel the automatic return to the main floor.
  4. When a down peak condition is recognized, the down call shall be served through the optimization process to provide efficient traffic handling. In extremely intense down traffic situations, the priority of the up calls is decreased to a preset value according to the main traffic flow preference system. The system shall provide equal service to every floor, even during exceptionally heavy down traffic.
  5. The system operation shall continuously change by demand and shall not require forced system changes to provide optimum operation and call response.
- h. Dispatch Protection: The system shall automatically provide dispatching in the event of failure of the primary system. A visible and audible alarm shall be provided to indicate loss of the dispatching computer.
  - i. Delayed Car Protection: The system shall automatically disassociate a car from the Group System in the event the car is delayed for a predetermined time. The car shall be automatically restored to the Group System when the cause of the delay has been eliminated.
  - j. Programmed Door Control: Separate adjustable times shall be provided for each car to establish minimum passenger transfer time for car stops, intermediate floor hall call stops and lobby floor stops. All timing shall be computerized to coincide with traffic demands.
  - k. Designated Parking: The system shall provide for cars to park as designated by the Group Controller or park at its last call.
  - l. Next Car: The car selected as next up at the lobby floor shall park with its door open. If an absence of calls exists, the door shall close automatically as commanded by the Group Controller.
- B. Tenant Security Operation:
1. Provide connection to a card reader or proximity reader mounted within the car pushbutton control station. Security readers will be provided and installed by the Owner. Contractor to coordinate as needed.

2. The insertion of magnetic reader card or indication of a proximity reader card activates the designated floor car call. Pressure on the designated floor car button illuminates and registers a call. The elevator proceeds to the designated floor, completes its operation and awaits the next demand.
  3. Fire Service and Earthquake Operation override the Security Service Operation.
- C. Independent Service: Provide controls to remove elevator from normal operation and provide control of the elevator from car buttons only. Car shall travel at contract speed and shall not respond to corridor calls.
- D. Car Top Operation: Provide car top controls, lighting and safety devices in accordance with Code requirements.
- E. Emergency Recall Operation (Fire Service): Provide operation and equipment per Code requirements. Provide a three-position key switch, marked "RESET -OFF-ON", at the main fire egress lobby. Any additional switches for control panels of alternate recall floors are to be two-position, marked "OFF-ON". Elevator Contractor shall provide relays, wiring, and terminal strips to receive signals from building fire alarm system.
- F. Load Weighing: Provide automatic load weighing device set at approximately 80% of full load. The device when activated shall cause the elevator to bypass corridor calls and shall initiate dispatch of car at main terminal prior to elapse of normal dispatching interval. Provide adjustable setting from 50 - 80% of full load. Cross head deflection type is unacceptable.
- G. False Call Canceling: Provide device to cancel all car calls when car loading is not equal to the number of calls registered.
- H. Standby Power Panel and Operation:
1. Elevator Contractor shall provide all control wiring for automatic sequential lowering and emergency power operation of all elevators. At least one elevator will operate simultaneously at contract speed. Elevators shall automatically return to and park at main lobby with doors open. In the event an elevator is out of service, after a predetermined time, emergency power shall automatically switch to the next elevator in sequence. After all elevators have returned to the main lobby, the preselected elevators shall remain on emergency power. In the event a preselected elevator is out of service, the next available elevator shall automatically be selected to remain on emergency power operation.
  2. Include all relays, auxiliary contacts and selector switches for emergency operation control and for motor starters in machine room.
  3. Power wiring from emergency source to emergency operating control provided by Electrical Contractor.
  4. All relays shall automatically reset as emergency supply becomes available for each car.
  5. Submit wiring diagrams for coordination.
  6. Emergency operation shall be arranged such that the elevator system shall sense a loss of normal power at each automatic transfer switch on an individual basis. Upon power loss at one transfer switch (partial power failure), no more than one elevator served by that transfer switch shall be capable of operating at one time. Upon loss of power at more than one elevator transfer switch, the elevators shall be interlocked such that no more than the selected elevators may operate simultaneously from the emergency power system. Sensing contacts at each transfer switch and related wiring to each elevator machine room shall be

by the Electrical Contractor. The Elevator Contractor shall coordinate with the Electrical Contractor to determine the type of sensing contacts required (normally open or normally closed) and the contact rating. Refer to the electrical drawings for number of transfer switches and elevators served.

7. Provide Emergency Power indicator at main landing.
  8. Machine Room Monitor: Provide a color monitor in each machine room capable of displaying status, position and critical items for trouble shooting the equipment.
- I. Provide elevator control circuitry that automatically shuts off the interior car lighting and fan when the elevators are not in use. Control circuitry shall comply with ASME A17.1, rule 2.14.7.2.2

## 2.5 HOISTWAY EQUIPMENT

- A. Guide Rails: Planed steel, standard T-sections. Extend rails from pit floor to underside of concrete slab or grating at top of hoistway.
- B. Buffer: Spring type with pipe struts and braces as required. Mount on continuous channels secured to guide rails.
- C. Sheaves: Provide steel machined and grooved for diameter of ropes and supported by steel beams or channels. Provide cable guards designed to withstand shock and prevent ropes from leaving their proper grooves. All bearings are to be shielded or sealed. Provide drip pans under deflector sheaves.
- D. Counterweights: Structural steel channel frame with metal filler weights. Provide metal guards as required by Code.
- E. Hoist and Governor Ropes: Provide 8 x 19 sealed construction traction steel type for the hoist ropes and 8 x 25 filler wire type for governor rope; fasten with adjustable shackles. Alternate means for hoisting and suspension are acceptable in accordance with Code requirements.
- F. Governor: Overhead centrifugal type, car and/or counterweight driven, with electrical overspeed and shutdown switches. Governor shall be self-resetting.
- G. Safety: Flexible guide clamp, Type B, car and counterweight as required.
- H. Automatic Terminal Stopping Device: Provide in accordance with Code requirements.
- I. Wiring:
  1. Conductors: Provide copper insulated wiring with flame retarding and moisture resisting outer cover. Install in galvanized metal wireways and raceways. Conductors from shaft riser to door interlocks shall be SF-2 type or equal, maximum operating temperature 392 degrees F. All terminations shall be insulated to maintain integrity of wiring. Flexible conduit may be used for short connections. Provide 10% spare conductors throughout.
  2. Trail Cables: UL labeled fire and moisture resistant outer braid and steel supporting strand. Provide pairs of shielded communication wires and car lighting circuits. Prevent cables from rubbing or chafing against hoistway or car items.
  3. Remote Wiring: Provide wiring between machine room, hoistway and remote locations of guard, security, life safety and fire control panels.

- 4. Provide a minimum of twelve shielded twisted pairs of communication wires and one coaxial cable for Owners use. Provide a separate junction box at the controller and on the car top that is clearly identified as "Security and Communication wiring and Coaxial Cable". All unused conductors shall be neatly coiled and stored within the junction box.
- J. Electrical devices in the pit shall be NEMA 4 weatherproof construction and wiring shall be listed for use in wet locations. This includes elevator equipment, receptacles, lighting and installed sump pump items. The pit light switch shall be located on the ladder side at least 48-inches above the lowest landing floor.

## 2.6 DOOR AND ENTRANCE EQUIPMENT

- A. General: Provide entrance assembly with UL 1 1/2 hour rating.
- B. Frames: Fabricate from 14 gauge cold rolled furniture steel in bolted assembly. A fireproof and sound-deadening material shall be applied to the unexposed side of each frame. Finish shall be satin stainless steel at all landings. Provide entrances that are 7' – 0" high at all floors. For additional design intent refer to architectural drawings.
- C. Provide handicapped designations at a height of 60" above the floor.
  - 1. The plaques shall have black numerals and Braille markings on a stainless steel background.
  - 2. Designations shall be flush with inconspicuous mechanical mounting.
- D. Provide elevator identification numbers and star of life identification on the entrance frames at lobby.
- E. Sills: Provide extruded aluminum entrance sills at all landings.
- F. Struts: Minimum 3-inch continuous hot rolled or formed steel angle with secure fastening to sill and floor beam above. If the contractor requires any additional support for their entrance equipment they should provide that work as part of their scope.
- G. Header: Minimum 3/16-inch thick-formed steel designed to support hangers. Header shall be bolted to supporting struts.
- H. Hanger Cover Plates: Removable, full length No. 14 gauge steel. Covers shall be made in sections for convenient access to hangers.
- I. Fascia: No. 14 gauge steel plates extending from top of header to sill of door above, or beam above if there is no door opening. Provide continuous fascia if front hoistway walls are not built out where openings do not exist.
- J. Toe Guard: No. 14 gauge sheet steel.
- K. Dust Cover: No. 14 gauge sheet steel.
- L. Door Bumpers: Provide on vertical struts at top and bottom.
- M. Doors: Door panels shall be hollow metal flush door construction, 16 gauge furniture steel. Fill with fireproof, sound deadening material. Provide reinforcement by formed vertical sections running full height of door. Doors shall be provided with two removable,

non-metallic gibs, located at the leading and trailing edge of the door panel. Provide heavy-duty door fire tabs similar to SEES Enforcer. Center opening doors shall be provided with full-length rubber astragal at leading edge of each door. Finish shall match the entrance frames at all floors. There shall be no visible exposed or protruding fasteners. Door roller and mounting assemblies shall be detachable and/or removable from the door panels. All door panels shall be equipped with door retainers and escutcheon tubes. Each landing door shall include a hoistway door safety lock installed in the hoistway door release key access point. Install Hoistway Door Safety Lock: Tri-Lok Model 1755, keyed TL1415. Provide at minimum four keys at conclusion of installation for each system.

- N. Sight guards: Provide for each landing door panel, constructed of No. 16 gauge furniture steel. Finish to match doors. Landing designations shall be permanently applied to the inside of each door panel.
- O. Hanger: Provide two-point suspension sheave type with provisions for vertical and lateral adjustments. Sheaves shall be minimum 2 1/4 inch in diameter with sealed ball or roller bearings.
- P. Tracks: Cold drawn steel shaped and finished to permit free movement of sheaves. Bottom of track shall be in contact with upthrust roller.
- Q. Closer: Heavy duty spirator type, similar to SmarTork, Inc.

## 2.7 CAR EQUIPMENT

- A. Car Frame: Welded or bolted steel channel construction.
- B. Car and Counterweight Sheaves: Provide cast iron machined and grooved for diameter of ropes and adequately supported. Provide cable guards designed to withstand shock and prevent ropes from leaving their proper grooves. All bearings are to be shielded or sealed.
- C. Platform: Isolated type, steel frame with steel or wood subfloor, fireproof on underside.
- D. Guide Shoes: Roller type with three or more sound-deadening rollers with adjustable springs or other method to maintain rail contact.
- E. Sill: Extruded aluminum with a non-slip surface.
- F. Toe Guard: Per Code.
- G. Hangers and tracks: Same as hoistway entrance doors hangers and tracks.
- H. Floor covering: Prepare for 1.5" flooring thickness and 10# per square foot. If final cab flooring is less than 1.5" than void shall be with sub-flooring to allow for future changes without modifying the car sill height.
- I. Door Protection:
  - 1. Electronic Entrance Detector Screen: Provide an electronic door edge device which projects a 3D infrared curtain of light guarding the door opening. Arrange to reopen doors if one beam of the curtain is penetrated. Unit shall have

- Transmitters and Receivers spaced at a minimum distance to provide the maximum amount of protection within the height of the doorway. Systems which have the ability to turn Off or On individual zones within the curtain will not be allowed.
2. Differential door timing feature: Provide adjustable timers to vary the time that the doors remain open in response to a car or hall call. The doors shall remain open for one second in response to a car call and five to eight seconds for a hall call. This time shall be reduced to 1/2 second if the entrance detector is interrupted. The doors shall remain open as long as passengers are crossing the threshold.
  3. Nudging: When doors are prevented from closing for 20 seconds due to failure of the entrance detector or obstruction, the doors shall close at reduced speed and a buzzer shall sound.
- J. Door Operator: Provide a linear type operator, similar to a Vertical Express HD-LM, ECI VFE2500-HL, Otis AT400 or GAL of Canada type operator, equipped with a closed loop continuous feedback controller. Door operator shall automatically open and close the car and hoistway doors. The doors shall be capable of smooth and quiet operation without slam or shock.
1. Opening speed shall not be less than 2.5 f.p.s. with reversal in no more than 2 1/2 inches.
  2. An auxiliary closing device shall automatically close hoistway doors if car leaves the landing zone.
  3. In case of power interruption, it shall be Possible to manually operate car and hoistway doors from inside the cab.
  4. Provide door safety retainers and restricted opening of car doors in accordance with Code requirements.
- K. Car Door Contacts: Electrical contacts shall prevent the operation of the elevator by normal operating devices unless car doors are closed or within tolerances allowed by Code.
- L. Car Enclosure: Car enclosure shall be manufactured by an approved company. Provide the following features:
1. General: The enclosure shall be adequately reinforced and ventilated to meet all the Code requirements. Provide sound-deadening mastic to exterior. Provide manufacturer's standard steel shell.
  2. Shell: Sides and back shall be 14 gauge sheet steel with baked enamel interior finish. Baked enamel color as selected by the Architect. Furnish and install new removable side and rear wall paneling to walls of the elevator constructed with fire rated wood substrate faced with 5WL finish for additional durability. Panel configuration shall be equally sized panels on the rear and side walls. Provide stainless steel reveals. Provide mounting method which prevents rattling or vibration.
  3. Canopy: Provide a minimum 8' 0" clear height under canopy. Reinforced 14 gauge furniture steel. Underside painted baked enamel reflective white. Arrange for hinged top emergency exit including lock as required by Code.
  4. Front return panels and entrance columns: 14 gauge sheet steel. Return panel shall be swing type to allow access to car station wiring and fixtures. Provide cabinets for special operating features and telephone required by these specifications. Finish shall be satin stainless steel.
  5. Car door panels: Same construction as hoistway door panel. Finish shall be satin stainless steel.

6. Ceiling: Provide perimeter cove LED lighting to maximize clear height available in elevator cab. Cab lighting shall be serviceable from car side and controlled via a key switch on car control panel. Lighting controller should allow for adjustment of light intensity. Interior lighting shall provide a minimum of 10 ftc. throughout the elevator interior. Provide clear access to the emergency exit per Code requirements. Cab lights and fan shall turn off after a predetermined period of inactivity. Both will be restored upon placing of a hall call, in compliance with ASME code requirements. Motion sensors shall not be used.
  7. Handrail: Provide upper and lower protection boards on full length of back wall and side walls of elevator cab. Provide minimum 2 1/2 inch thick by 12 inch high #2 Oak protection boards located to prevent damage from loading and unloading.
  8. Pads and Hooks: Provide pad hooks and pads. Pad hooks shall be conspicuous type (buttons) at front return panels at sides and rear walls. Mount pad hooks at sides and rear above suspended ceiling line. Pads shall cover all walls and front return panels.
  9. Ventilation: Provide Two-speed blower assembly.
- M. Car Top Safety Railing: Provide a car top safety railing and toe guard kick plates on each elevator car. Installed safety railings shall be designed and installed in accordance with current ASME A17.1 and OSHA safety standards.
- N. Unique Identifier: Provide elevator identification number at the main landing in accordance with ASME A17.1, rule 2.29.1.

## 2.8 SIGNALS AND FIXTURES

- A. Provide vandal resistant stainless steel signal fixtures with no exposed fasteners. The intent is not to furnish any button, module or key switch that utilizes a plastic bezel or mounting plate. All operating panels shall be custom designed as indicated on Architectural drawings. All hall and car pushbutton illumination/acknowledgement shall be back lit with blue LED technology.
- B. Car Operating Panels:
1. Provide a main car operating panel for all elevators and provide an auxiliary car operating panel for all elevators with a rear opening. Panels shall have illuminating pushbuttons numbered to conform to floors served. Buttons shall light to show registration and extinguish when car stops in response to a call. Buttons shall be solid with illuminating rings and raised 1/8 inch +/- 1/32 inch above the faceplate. Each panel shall include an alarm bell button, DOOR OPEN and DOOR CLOSE button. All operating controls shall be located no higher than 54" for side approach and 48" for front approach above the car floor, (35" for alarm button). Provide main car panel with Phase II emergency fire service switch and associated components in a locked cabinet as required by rule 2.27.3.3.7. and hands free ADA type telephone system. All exposed metals shall be satin stainless steel finish.
  2. Provide Independent Service key switch mounted in the face of the car station mounted above the floor buttons. Make sure to key this switch differently than the locked service cabinet to prevent unauthorized people from gain access to those devices.
  3. Braille/Arabic designations shall be flush with inconspicuous mechanical mounting.



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- a. The plaques shall have light colored numerals on a black background. The numeral color is to be eggshell finish (11 to 19 degree gloss).
  - 4. Provide a service cabinet with a locked concealed hinged door.
    - a. Cabinet shall contain the following toggle type controls:
      - 1. A light switch.
      - 2. Two speed fan switch.
      - 3. Inspection switch, conforming to the ASME Code.
      - 4. A duplex 120 volt, A.C. convenience outlet.
      - 5. Emergency Stop Switch.
      - 6. Emergency Light Test Switch.
    - 4. Engrave the car operating panels with the following (Engraved applied and laser etched signage is unacceptable):
      - a. No Smoking. Minimum 1 inch high lettering.
      - b. Elevator Number over operating buttons. Minimum 1/4 inch high lettering.
      - c. Elevator Capacity. Minimum 1/4 inch high lettering.
      - d. Firefighters Operating Instructions. Minimum 1/8 inch high lettering.
      - e. Warning – Elevators shall not be used in the event of fire. Use marked exits. Minimum 1/4 inch lettering.
  - C. Car Position Indicator: Provide digital readout type with 2" high (minimum) indications over each operating panel. Provide voice annunciation system.
  - D. Hall Buttons: Provide one riser of hall pushbuttons for passenger elevators. Station shall include flush mounted faceplate. Centerline of riser to be at 3'-6" above the finished floor. Buttons shall be raised 1/8 inch +/- 1/32 inch above the faceplate. Fire signs shall be integral within the faceplate. Provide Code required Phase I key switch and operational instructions engraved on the faceplate, at the main lobby. Incorporate Emergency Power Indicator and key switch and Communication Failure signal in the main lobby hall station. Fire signs shall be engraved and integral within the faceplate, at all floors. Finish shall be satin finish stainless steel. Engraved and integral signs shall be as follows:
    - 1. Fire Signs. Minimum 1/2 inch high lettering.
    - 2. Fire Operational Instructions. Minimum 1/8 inch high lettering
  - E. Car Direction Indicator: Provide one (1) new UP and DOWN lantern mounted in each car entrance jamb. Mount in jamb in order to be visible from the proximity of the hall station. Electronic chimes shall sound twice for the down direction of travel. Finish shall match the entrance columns.
  - F. Combination Hall Position and Direction Indicator: Provide at the main lobby a combination lantern with digital 2" high (minimum) indications, direction of travel arrows and hall lantern arrows. Faceplate material identical to hall button faceplate.
  - G. Hoistway Access Switch: Mount with faceplate in entrance frame side jamb at all top terminals and bottom terminals where walk in pits are not provided. Faceplate to match hall button finish.
  - H. Elevator Status Panel: Provide a common fire control panel for all elevators, locate as directed. Panel to contain a digital readout type position and direction indicator per elevator; Fireman's return switch per group or individual elevator as required; a jewel to indicate if doors are open at the fire egress floor per elevator; in car fire service jewel per

elevator; space for fireman's phone jack; a cabinet containing the in car fire service keys with instructions for fire service operation and emergency power rotary selector switches and status indicators. Use of CRT type monitors is unacceptable.

- I. Emergency Car Lighting and Alarm System: Unit shall provide LED type emergency light in car upon failure or interruption of normal car lighting. Emergency lighting unit shall provide a minimum illumination of 0.2 foot-candle at 4 feet above car floor approximately 1 foot in front of car operating panel for not less than 4 hours. Battery shall be 6 volt minimum, sealed rechargeable lead acid or equal. Battery charger shall be capable of restoring battery to full charge within 16 hours after resumption of normal power. Provide an external means for testing battery, lamps, and alarm bell. Emergency lighting system shall be designed to power the elevator interior lighting system.
- J. Machine Room Monitors: Provide a monitor in each machine room capable of displaying status, position and critical items for trouble shooting the equipment.
- K. Voice Annunciator: Provide a new voice annunciator manufactured by CE Electronics, Inc. Provide a unit with the following voice messages in a female voice.
  - 1. Name of floor and direction of travel. *"Second Floor, Going Up"*.
  - 2. This elevator is now in fire return. When the doors open, please exit the building in a safe and orderly manner.
  - 3. Please stand clear of the closing doors.
  - 4. This elevator is on independent service.
  - 5. This car is in overload status. Please remove part of the load to resume service.
  - 6. This elevator is now on emergency power and the car is returning to the main level.
  - 7. This car is now on inspection service.
  - 8. This elevator is needed because of an emergency. Please exit the elevator when the doors open.

## 2.9 COMMUNICATION SYSTEM

- A. Telephone System: Provide ADA hands free telephone system integral with main car return panel. Engrave all required signage and operating instructions.
- B. Provide an emergency two-way video elevator communication system for the deaf, hard of hearing and speech impaired. Provide the following features:
  - 1. Visual and text based with live interactive video.
  - 2. System shall be fully accessible by the deaf, hard of hearing and speech impaired, and shall provide voice only options for hearing individuals.
  - 3. System shall have the ability to communicate with emergency personnel utilizing video conference, chat/text features or other approved technology.
  - 4. All cameras, screens and associated devices shall be located at an accessible height.
- C. Provide wiring from car to telephone terminal box in elevator machine room.
- D. Provide installation of Life Safety speaker provided by others within the elevator cab.
- E. Provide wiring from car to Life Safety junction box in machine room.

- F. Provide a system that allows for two-way communication between the elevator car and machine room in accordance with ASME A17.1, rule 2.27.1.1.4 and 2.7.8.4.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. The elevator contractor shall examine the supporting structure and the conditions under which the work shall be installed and notify the contractor of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected and are acceptable.
- B. Verify dimensions of supporting structure at the site by accurate field measurements. The work shall be accurately fabricated and fitted to the structure. Elevator contractor shall satisfy himself by review of the working drawings and field observation that the clearances and the alignments are proper for the installation of this work.
- C. Coordinate work with the work of other trades and provide items to be placed during the installation at the proper time to avoid delays in the overall work. Use contractor's benchmarks where necessary.
- D. The elevator contractor shall review the electrical drawings and verify all conditions for proper installation of this work. Verify the size of all feeders and related equipment and furnish all equipment for proper operation. The elevator contractor shall be responsible for furnishing any electrical changes or upgrades required.

#### **3.2 FIELD QUALITY CONTROL**

- A. Tests:
  - 1. Perform as required by Code and as required by authorities having jurisdiction.
  - 2. Provide labor, materials, equipment and connections.
  - 3. All test results shall be documented and submitted for approval.
  - 4. Repair or replace defective work as required.
  - 5. Pay for restoring or replacing damaged work due to tests.
- B. Final Inspection: When all work is completed, and tested, notify the Owner in writing that the elevator is ready for final inspection and acceptance test. A testing and inspection date shall then be arranged. The proper operation of every part of the elevator system, compliance with contract requirements and ASME Code requirements shall be demonstrated to the Owner. Furnish all test instruments, weights, and materials, required at the time of final inspection.
  - 1. Final System Tests for Smoke Detection/Fire Elevator Recall: After work is completed, conduct a final test of entire system. Submit results on approved test report forms.
  - 2. Reinspection: If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to the requirements of the contract specifications or the Safety Code, no approval or acceptance of the elevators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected. The Owner shall be notified and the elevator shall be reinspected. Rejected elevators shall not be used until they have been reinspected and approved.

If deficiencies are found, or if the consultant/owner deems it to be necessary the contractor shall perform the following tests at no additional charge immediately following the final inspection.

1. Test Period: The elevator shall be subjected to a test for a period of one hour continuous run, with full specified load in the car. During the test run, the car shall be stopped at all floors in both directions of travel for a standing period of 10 seconds per floor.
2. Speed Load Tests: The actual speed of the elevator car shall be determined in both directions of travel with full contract load and with no load in the elevator car. Speed shall be determined by a tachometer. The actual measured speed of elevator car with full load shall be within 5% of rated speed. The maximum difference in actual measured speeds obtained under the various conditions outlined between the "UP" and the "DOWN" directions shall be checked.
3. Floor-to-floor times with no load in the car, balanced load in the car and full load in the car shall be checked.
4. Car Leveling Tests: Elevator car leveling devices shall be tested for accuracy of landing at all floors with no load in the car, balanced load in; the car and full load in the car, in both directions of travel. Accuracy of floor landing (plus or minus 1/4 inch) shall be determined both before and after the full-load run test.
5. Insulation Resistance Tests: The complete wiring systems of the elevator shall be free from short circuits and grounds, and the insulation resistance shall be determined by use of a "Megger." Conductors shall have an insulation resistance of not less than one megohm between each conductor and ground and between each conductor and all other conductors.
6. Reinspection: If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to the requirements of the contract specifications or the Safety Code, no approval or acceptance of the elevators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected. The Owner shall be notified and the elevator shall be reinspected. Rejected elevators shall not be used until they have been reinspected and approved.

### 3.3 ADJUSTING AND CLEANING

- A. All equipment shall be adjusted prior to final testing and acceptance.
- B. Paint exposed work soiled or damaged during installation. Repair to match adjoining work prior to final acceptance. At a minimum all hoistway and machine room components shall be field painted with at least one coat of machine grade enamel. Paint the machine room walls in an off white color and the machine room and pit floors grey. The intent is to provide a complete final product that is neat, clean and painted.

**END OF SECTION**

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Section 14 42 16  
VERTICAL WHEELCHAIR LIFT

**PART 1 – GENERAL**

1.1 GENERAL PROVISIONS

- A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
  - 1. Self-contained unenclosed, low-rise, pit mounted Interior wheelchair lift.
- B. Perform complete factory finishing of all metal surfaces, except for bright metal work.
- C. Provide maintenance and call-back services for lift equipment furnished hereunder.
- D. Furnish the following products to be installed under the designated Sections:
  - 1. Inserts required to be built into concrete, for installation under Section 03 30 00 - CAST-IN-PLACE CONCRETE.

1.3 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Embedded concrete anchorage.
- B. Division 26 - ELECTRICAL: Electrical service for wheelchair lift operations.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ANSI/ASME A 17.1. - Safety Code for Elevators and Escalators.
  - 2. ASME A17.5 - Elevator and Escalator Electrical Equipment.
  - 3. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 4. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
  - 5. NFPA 70 - National Electric Code.
- B. General References The following reference materials are hereby made a part of this Section by reference thereto:
  - 1. UL: Applicable requirements for motors, switches and other electrical components.

2. All applicable federal, state and municipal codes, laws and regulations for wheelchair lifts, including barrier-free requirements.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

##### B. Sequencing:

1. Field Measurements
  - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
  - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

##### C. Scheduling:

1. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows, or doors to place and install the work of this Section shall be performed at no additional cost to the Owner.

#### 1.6 SUBMITTALS

##### A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, for lift components furnished hereunder.
2. Shop Drawings: General arrangement for all wheelchair lift, dimensioned installation details with, landing heights, gate dimensions, tolerances of landing dimensions, perimeter conditions of construction, and all electrical characteristics and requirements for the lift equipment.
3. Selection Samples: Sample chips of all finishes in elevator lift, and all available colors for, paints, and finishes, for selections by the Architect.
4. Verification Samples: For each finished material, furnish 6 inch (150 mm) square samples, representing actual product, color, and patterns.

##### B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Maintenance Contracts: Provide Installers maintenance contract, for a period of not less than one year from date of Substantial Completion of the General Contract. Maintenance contract shall include the following:
  - a. 24-hour emergency callback service for the equipment.
  - b. Examinations of the installation during regular working hours by trained employees of the wheelchair lift installer.
  - c. All necessary adjusting, greasing, and oiling.

- d. Providing cleaning supplies and parts necessary to keep the equipment in proper operation, except any parts needed due to misuse, accident, or neglect caused by others.
2. Operation and Maintenance Data:
  - a. Parts list and as-built wiring diagrams for controller and lift system.
  - b. Maintenance instruction manual.
3. Bonds and Warranty Documentation:
  - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

#### 1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of wheelchair lift.
- C. Qualifications:
  1. Manufacturers: Minimum 10 years experience in manufacturing of vertical platform lifts, with evidence of experience with similar installations of type specified.
  2. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
  3. Welders Certificates: Utilize only qualified welders employed on the Work. Submit verification that Welder's are AWS D1.1 and D1.4 qualified within the previous 12 months.
- D. Certifications: All load ratings and safety factors shall meet or exceed those specified in the local applicable elevator safety code and shall be certified by a professional engineer.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
  1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Storage and Handling Requirements:
  1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
  2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.



1.9 WARRANTY

- A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.
- B. Manufacturer Warranty: Provide manufacturer's standard 2 year warranty countersigned by the installer, which shall include all materials and workmanship for wheelchair lift and installation.
- C. Special Warranty: Provide extended 3 year warranty beyond the specified manufacturer's 2 year warranty (total 5 years), covering the wheelchair lift materials and workmanship, with a preventative maintenance program contracted directly with Owner.

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Garaventa Lift, , Blaine, WA., model series "Genesis Opal".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  - 1. AmeriGlide Inc., Raleigh NC.
  - 2. Concord Elevator, Inc., Pacoima, CA.
  - 3. Garaventa Lift, Blaine, WA.
  - 4. Savaria, Brampton, ON, Canada

2.2 DESCRIPTION

- A. General Description: Wheelchair (platform) lifts include driving machines, lift enclosures, entrance gates, guide rails, signal equipment, control systems, internal electrical wiring; and all devices for operation, dispatching, safety, security, leveling, and alarms Lifts shall in accordance with the requirements of ASME/ANSI A 17.1 Safety Code for Elevators and Escalators, and State Building Code, as revised and amended per the rules and regulations of local authorities and all other governing bodies which may have jurisdiction, including all regulations for the physically handicapped.
- B. Regulatory Requirements
  - 1. Provide wheelchair lifts in compliance with:
    - a. ANSI/ASME A 17.1. - Safety Code for Elevators and Escalators.
    - b. ASME A17.5 - Elevator and Escalator Electrical Equipment.
    - c. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
    - d. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
    - e. NFPA 70 - National Electric Code.
- C. Permits, Tests and Inspections:

1. Obtain and pay for all necessary municipal and State elevator inspections and permits; make all tests as required by the regulations of such authorities. The capacity and operational performance tests shall be conducted in the presence of the Architect and the code enforcement officer, after completion of the installation.
2. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.

### 2.3 PERFORMANCE/DESIGN CRITERIA

- A. Rated Capacity: 750 lbs (340 kg) load capacity.
- B. Travel Speed: 9 to 10 feet per minute.
- C. Number of Stops: 2
- D. Total Rise: As indicated on Drawings.

### 2.4 VERTICAL WHEELCHAIR LIFT

- A. Nominal Clear Platform Dimensions:
  1. Large 90 degree: 42 inches (1067 mm) by 60 inches (1524 mm) with 90-degree entry/exit configuration.
- B. Platform Configuration:
  1. 90 Degree Entry/Exit: Front and side openings.
- C. Landing Openings: Gates shall be self-closing.
  1. Gate Height: Flush mount, 42-1/8 inches (1070 mm).
  2. Width: Nominal 42 inches (1067 mm).
  3. Power Door/Gate Operator: Automatically opens the door/gate when platform arrives at a landing. Will also open at landing by pressing call button or gently the pulling door.
    - a. ADA Compliant and obstruction sensitive.
    - b. Low voltage, 24 VDC with all wiring concealed.
    - c. Location:
      - 1) Lower Landing: Door.
      - 2) Upper landing: Gate.
- D. Lift Components:
  1. Machine Tower: Aluminum extrusion.
  2. Base Frame: Structural steel.
  3. Platform Side Wall Panels: 16 gauge (1.5 mm) galvanized steel sheet. Custom aluminum extrusion tubing frame.
- E. Base Mounting and Access to Lift at Lower Landing:
  1. Pit Mount: Lift to be mounted in pit with dimensions to meet manufacturers requirements for the platform size specified.
- F. Leadscrew Drive:

1. Drive Type: Self-lubricating acme screw drive.
  2. Emergency Operation: Manual handwheel device to raise or lower platform.
  3. Safety Devices:
    - a. Integral safety nut assembly with safety switch.
  4. Motor: 2.0 hp (560 W).
  5. Power Supply:
    - a. 120 VAC single phase; 60 Hz on a dedicated 20 amp circuit.
- G. Platform Controls: 24 VDC control circuit with the following features.
1. Direction Control: Constant pressure rocker switch.
  2. Illuminated and audible emergency stop switch shuts off power to lift and activates audio alarm equipped with battery backup.
  3. Keyless operation.
- H. Call Station Controls: 24 VDC control circuit with the following features.
1. Direction Control: Constant pressure rocker switch.
  2. Keyless operation.
  3. Keyed operation.
  4. Call Station Mounting:
    - a. Lower: Wall mounted surface.
    - b. Upper: Wall mounted surface.
- I. Safety Devices and Features:
1. Grounded electrical system with upper, lower, and final limit switches.
  2. Tamper resistant interlock to electrically monitor that the door is in the closed position and the lock is engaged before lift can move from landing.
  3. Electrical disconnect shall shut off power to the lift.

## 2.5 FINISHES

- A. Shop Finishing:
1. Lift Finish: Baked powder coat finish, color as selected by the Architect from manufacturers optional RAL color chart.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions:
1. Inspect all surfaces and verify required embedded anchorage devices, and verify that they are in proper condition and location to receive the work of this Section.
  2. Verify that field measurements are as indicated on approved shop drawings
  3. Beginning of installation means acceptance of existing substrate and project conditions.

### 3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.

### 3.3 INSTALLATION

- A. Perform the installation in accordance with the approved shop drawings and the manufacturer's written instructions, with standards ASME A17.1, ASME A18.1 and as required by authority having jurisdiction, and with additional requirements as specified herein.
- B. Set wheelchair lift square and level. Anchor unit securely to building structure.
- C. Furnish and install all internal and operational wiring, conforming to the requirements of the National Electrical Code, as necessary to connect the operating buttons and switches, from the control board to the power unit. Except for short lengths of flexible conduit to moving apparatus, ensure that all wiring is contained in rigid conduit or electrical metal tubing.

### 3.4 TOLERANCES

- A. Maximum variation from plumb or level: 1/4 inch.
- B. Maximum offset from true dimensional alignment: 1/4 inch.

### 3.5 FIELD QUALITY CONTROL

- A. Field inspection will be performed under the provisions of Section 01 45 00 - QUALITY CONTROL.
  - 1. Perform tests in compliance with ASME A 17.1 or A18.1 and as required by authorities having jurisdiction.

### 3.6 ADJUSTING

- A. Adjust installed lift and gates for smooth and balanced operation.

### 3.7 CLEANING

- A. After all work under this Section has been completed and satisfactorily tested, remove all applied packing labels from the various surfaces, thoroughly clean all prefinished surfaces. Touch up all scratches, abrasions, and other surface defects in the prefinished surfaces, using the same material, color, and gloss as used in the prefinishing system.
- B. Clean work under provisions of Section 01 70 00 – EXECUTION.

### 3.8 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

3.9 MAINTENANCE

- A. Provide Installers maintenance contract under provisions of Section 01 77 00 – CLOSEOUT PROCEDURES, for a period equal to extended warranty. Maintenance contract shall include the following:
  - 1. Emergency callback service for the equipment.
  - 2. Scheduled examinations of the installation, every 6 months during maintenance period, occurring during regular working hours by trained employees of the wheelchair lift manufacturer.
  - 3. All necessary adjusting, greasing, and oiling.
  - 4. Cleaning supplies and parts necessary to keep the equipment in proper operation, except any parts needed due to misuse, accident, or neglect caused by others.
  
- B. Repair work shall be carried out only by the installer's personnel, using only standard parts furnished by the wheelchair manufacturer. Maintenance shall be carried out directly by the wheelchair installer and shall not be assigned or transferred to any agent.

End of Section

Section 21 05 17

SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Stack-sleeve fittings.
  - 3. Sleeve-seal systems.
  - 4. Sleeve-seal fittings.
  - 5. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

- G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

## 2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

## 2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Linkseal
4. Metraflex Company (The).
5. Pipeline Seal and Insulator, Inc.
6. Proco Products, Inc.

- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel or Stainless steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## 2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Presealed Systems.

- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

**PART 3 - EXECUTION**

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Fire rating of walls, partitions, ceilings, and floors at pipe penetrations are not included in this section and will be performed by the firestopping contractor under Section 078413 "Penetration Firestopping."



### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

### 3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: [Galvanized-steel wall sleeves with sleeve-seal system].
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 2. Concrete Slabs above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves
  - 3. Interior Partitions:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

End of Section

Section 21 05 18

ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
    - c. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
    - d. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
    - e. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece or split-casting, floor-plate type.

#### 3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

End of Section

Section 21 05 23

GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Two-piece ball valves with indicators.
  - 2. Bronze butterfly valves with indicators.
  - 3. Iron butterfly valves with indicators.
  - 4. Check valves.
  - 5. Bronze OS&Y gate valves.
  - 6. Iron OS&Y gate valves.
  - 7. NRS gate valves.
  - 8. Indicator posts.
  - 9. Trim and drain valves.

1.3 DEFINITIONS

- A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- B. NRS: Nonrising stem.
- C. OS&Y: Outside screw and yoke.
- D. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, and weld ends.

3. Set valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
  2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.
- D. Protect flanges and specialties from moisture and dirt.

## **PART 2 - PRODUCTS**

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
1. Main Level: HAMV - Fire Main Equipment.
    - a. Level 1: HCBZ - Indicator Posts, Gate Valve.
    - b. Level 1: HLOT - Valves.
      - 1) Level 3: HLUG - Ball Valves, System Control.
      - 2) Level 3: HLXS - Butterfly Valves.
      - 3) Level 3: HMER - Check Valves.
      - 4) Level 3: HMRZ - Gate Valves.
  2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
    - a. Level 1: VQGU - Valves, Trim and Drain.
- B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
1. Automated Sprinkler Systems:
    - a. Indicator posts.
    - b. Valves.
      - 1) Gate valves.
      - 2) Check valves.
        - a) Single check valves.
      - 3) Miscellaneous valves.

- C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.
- D. ASME Compliance:
  - 1. ASME B16.1 for flanges on iron valves.
  - 2. ASME B1.20.1 for threads for threaded-end valves.
  - 3. ASME B31.9 for building services piping valves.
- E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- F. NFPA Compliance: Comply with NFPA 24 for valves.
- G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.
- H. Valve Sizes: Same as upstream piping unless otherwise indicated.
- I. Valve Actuator Types:
  - 1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
  - 2. Handwheel: For other than quarter-turn trim and drain valves.
  - 3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

## 2.2 TWO-PIECE BALL VALVES WITH INDICATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ames Fire & Waterworks; A WATTS Brand.
  - 2. NIBCO INC.
  - 3. Victaulic Company.
- B. Description:
  - 1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
  - 2. Pressure Rating: 250 psig.
  - 3. Body Design: Two piece.
  - 4. Body Material: Forged brass or bronze.
  - 5. Port Size: Full or standard.
  - 6. Seats: PTFE.
  - 7. Stem: Bronze or stainless steel.
  - 8. Ball: Chrome-plated brass.
  - 9. Actuator: Worm gear or traveling nut.
  - 10. Supervisory Switch: Internal or external.
  - 11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
  - 12. End Connections for Valves NPS 2-1/2: Grooved ends.

### 2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ALEUM USA.
2. Globe Fire Sprinkler Corporation.
3. Milwaukee Valve Company.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
2. Pressure rating: 250 psig.
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: Bronze or Stainless steel with EPDM coating.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

### 2.4 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Kennedy Valve Company; a division of McWane, Inc.
2. NIBCO INC.
3. Tyco by Johnson Controls Company.
4. Victaulic Company.
5. Zurn Industries, LLC.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Pressure Rating: 250 psig.
3. Body Material: Cast or ductile iron.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Grooved-end connections.

## 2.5 CHECK VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Globe Fire Sprinkler Corporation.
2. Kennedy Valve Company; a division of McWane, Inc.
3. NIBCO INC.
4. Reliable Automatic Sprinkler Co., Inc. (The).
5. Tyco by Johnson Controls Company.
6. Victaulic Company.
7. Viking Corporation.
8. WATTS.
9. Zurn Industries, LLC.

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Pressure Rating: 250 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

## 2.6 BRONZE OS&Y GATE VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Milwaukee Valve Company.
2. NIBCO INC.
3. Zurn Industries, LLC.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Pressure Rating: 250 psig.
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.



## 2.7 IRON OS&Y GATE VALVES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. NIBCO INC.
2. Victaulic Company.
3. WATTS.
4. Zurn Industries, LLC.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Pressure Rating: 250 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: [Flanged] Grooved.

## 2.8 NRS GATE VALVES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American Cast Iron Pipe Company.
2. Kennedy Valve Company; a division of McWane, Inc.
3. Mueller Co.
4. NIBCO INC.
5. Victaulic Company.
6. Zurn Industries, LLC.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Pressure Rating: 250 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged.

2.9 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
  - b. Milwaukee Valve Company.
  - c. NIBCO INC.
  - d. Potter Roemer LLC; a Division of Morris Group International.
  - e. Tyco by Johnson Controls Company.
  - f. Victaulic Company.
  - g. WATTS.
  - h. Zurn Industries, LLC.
2. Description:
  - a. Pressure Rating: 250 psig.
  - b. Body Design: Two piece.
  - c. Body Material: Forged brass or bronze.
  - d. Port size: Full or standard.
  - e. Seats: PTFE.
  - f. Stem: Bronze or stainless steel.
  - g. Ball: Chrome-plated brass.
  - h. Actuator: Handlever.
  - i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
  - j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Fire Protection Products, Inc.
  - b. NIBCO INC.
  - c. United Brass Works, Inc.
2. Description:
  - a. Pressure Rating: 250 psig.
  - b. Body Material: Brass or bronze.
  - c. Ends: Threaded.
  - d. Stem: Bronze.
  - e. Disc: Bronze.
  - f. Packing: Asbestos free.
  - g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. NIBCO INC.
  - b. United Brass Works, Inc.
2. Description:
  - a. Pressure Rating: 250 psig.
  - b. Body Material: Bronze with integral seat and screw-in bonnet.
  - c. Ends: Threaded.
  - d. Stem: Bronze.
  - e. Disc Holder and Nut: Bronze.
  - f. Disc Seat: Nitrile.
  - g. Packing: Asbestos free.
  - h. Handwheel: Malleable iron, bronze, or aluminum.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

#### **3.2 GENERAL REQUIREMENTS FOR VALVE INSTALLATION**

- A. Comply with requirements in the following Sections for specific valve installation requirements and applications:
  1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for application of valves in fire-suppression water-service piping outside the building.
  2. Section 211200 "Fire-Suppression Standpipes" for application of valves in fire-suppression standpipes.
  3. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.

4. Section 211316 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.
  - B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
  - C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
  - D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
  - E. Install valves in horizontal piping with stem at or above the pipe center.
  - F. Install valves in position to allow full stem movement.
  - G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.
  - H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.
  - I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

End of Section

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Section 21 05 53

IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Valve tags.
  - 5. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.
- D. Valve Schedules: Valve numbering scheme.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each piping system to include in maintenance manuals.

**PART 2 - PRODUCTS**

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch stainless steel, 0.025 inch aluminum, 0.032 inch with predrilled holes for attachment hardware.
  2. Letter Color: White.
  3. Background Color: Red.
  4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  6. Fasteners: Stainless-steel rivets or self-tapping screws.
  7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, with predrilled holes for attachment hardware.
  2. Letter Color: White.
  3. Background Color: Red.
  4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  7. Fasteners: Stainless-steel rivets or self-tapping screws.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.
- 2.2 WARNING SIGNS AND LABELS
- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, with predrilled holes for attachment hardware.
  - B. Letter Color: Red.
  - C. Background Color: White.

- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

### 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.
- B. Pretensioned Pipe Labels: Pre-coiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; pipe size; and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.
- E. Pipe-Label Colors:
  - 1. Background Color: Red.
  - 2. Letter Color: White.

### 2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch-thick, with predrilled holes for attachment hardware.
  - 2. Fasteners: Brass wire-link chain or S-hook.



3. Fasteners: Brass wire-link chain or S-hook.
4. Valve-Tag Color: Red.
5. Letter Color: White.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 LABEL INSTALLATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install or permanently fasten labels on each major item of mechanical equipment.
- D. Locate equipment labels where accessible and visible.
- E. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting." or Section 099600 "High-Performance Coatings."
- F. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

### 3.3 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems. List tagged valves in a valve-tag schedule.
  
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
  1. Valve-Tag Size and Shape:
    - a. Fire-Suppression Standpipe: 1-1/2 inches round.
    - b. Wet-Pipe Sprinkler System: 1-1/2 inches round.

### 3.4 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

End of Section

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Section 21 11 00

FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes fire-suppression water-service piping and related components outside the building and service entrance piping through floor into the building and service entrance piping through wall into the building.
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.
- C. Related Sections:
  - 1. Section 211200 "Fire-Suppression Standpipes" for fire-suppression standpipes inside the building.
  - 2. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe fire-suppression sprinkler systems inside the building.
  - 3. Section 211316 "Dry-Pipe Sprinkler Systems" for dry-pipe fire-suppression sprinkler systems inside the building.

1.3 APPLICABLE CODES AND STANDARDS

- A. The specifications and standards listed below form a part of this section of the specifications. The system shall fully comply with the latest issue, with all updates, of these standards as applicable. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.
  - 1. New York State Codes and Regulations
    - a. New York State Uniform Fire Prevention and Building Code
  - 2. NFPA Standards
    - a. NFPA 13, Standard for the Installation of Sprinkler Systems
    - b. NFPA 14, Standard for the Installation of Standpipe and Hose Systems
    - c. NFPA 24, Standard for the Installation of Private Service Mains and Their Appurtenances
    - d. NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems.
    - e. NFPA 72, National Fire Alarm and Signaling Code.
  - 3. Americans with Disabilities Act and Architectural Barriers Act
    - a. Accessibility Guidelines

4. FM Global Datasheets and Forms
  - a. 2-0, *Installation Guidelines for Automatic Sprinklers*
  - b. 3-0, *Hydraulics of Fire Protection Systems*
  - c. 3-26, *Fire Protection Water Demand for Non-Storage Sprinklered Occupancies*
  - d. Form 85A, *Contractor's Material and Test Certificate for Automatic Sprinkler System*

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
  2. Wiring Diagrams: For power, signal, and control wiring.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- B. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:
  1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
  2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. 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.
- D. Comply with the "Approval Guide," published by FM Global, or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
  - 1. Ensure that valves are dry and internally protected against rust and corrosion.
  - 2. Protect valves against damage to threaded ends and flange faces.
  - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
  - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
  - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

## 1.8 COORDINATION

- A. Coordinate connection to water main with utility company.

## PART 2 - PRODUCTS

### 2.1 DUCTILE-IRON PIPE AND FITTINGS

- A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
- B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.
- C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.

D. Grooved-End, Ductile-Iron Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Anvil International, Inc.
  - b. Shurjoint Piping Products.
  - c. Star Pipe Products.
  - d. Victaulic Company.
  - e. Or approved equal
2. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
3. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

F. Push-on-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.

1. Gaskets: AWWA C111, rubber.

G. Flanges: ASME B16.1, Class 150, cast iron.

## 2.2 SPECIAL PIPE FITTINGS

A. Ductile-Iron Flexible Expansion Joints:

1. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
2. Pressure Rating: 250 psig minimum.

B. Ductile-Iron Deflection Fittings:

1. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
2. Pressure Rating: 250 psig minimum.

### 2.3 JOINING MATERIALS

- A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.
- C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

### 2.4 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

### 2.5 GATE VALVES

- A. AWWA Gate Valves:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American AVK Company; Valves & Fittings Division.
    - b. American Cast Iron Pipe Company; American Flow Control Division.
    - c. American Cast Iron Pipe Company; Waterous Company Subsidiary.
    - d. American R/D.
    - e. Clow Valve Company; a division of McWane, Inc.
    - f. Crane Co.; Crane Valve Group; Stockham Division.
    - g. East Jordan Iron Works, Inc.
    - h. Kennedy Valve; a division of McWane, Inc.
    - i. M&H Valve Company; a division of McWane, Inc.
    - j. Mueller Co.; Water Products Division.
    - k. NIBCO INC.
    - l. Tyler Pipe; a division of McWane, Inc.; Utilities Division.
    - m. U.S. Pipe.
    - n. Or approved equal
  - 2. 250-psig, AWWA, Iron, Nonrising-Stem, Resilient-Seated Gate Valves:
    - a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
    - b. Standard: AWWA C509.
    - c. Pressure Rating: 250 psig.
    - d. End Connections: Mechanical or push-on joint.
    - e. Interior Coating: Complying with AWWA C550.
  - 3. 250-psig, AWWA, Iron, OS&Y, Resilient-Seated Gate Valves:



- a. Description: Cast- or ductile-iron body and bonnet; with bronze, gray-iron, or ductile-iron gate; resilient seats; and bronze stem.
  - b. Standard: AWWA C509.
  - c. Pressure Rating: 250 psig.
  - d. End Connections: Flanged or grooved.
4. Class 150, Bronze, Nonrising-Stem Gate Valves:
- a. Description: Class 150, Type 1; bronze with solid wedge and malleable-iron handwheel.
  - b. Standard: MSS SP-80.
  - c. Pressure Rating: 200 psig.
  - d. End Connections: Solder joint or threaded.
- B. UL-Listed and FM-Approved Gate Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American AVK Company; Valve & Fittings Division.
    - b. American Cast Iron Pipe Company; American Flow Control Division.
    - c. American Cast Iron Pipe Company; Waterous Company Subsidiary.
    - d. Clow Valve Company; a division of McWane, Inc.
    - e. Crane Co.; Crane Valve Group; Jenkins Valves.
    - f. Crane Co.; Crane Valve Group; Stockham Division.
    - g. East Jordan Iron Works, Inc.
    - h. Hammond Valve.
    - i. Kennedy Valve; a division of McWane, Inc.
    - j. M&H Valve Company; a division of McWane, Inc.
    - k. Milwaukee Valve Company.
    - l. Mueller Co.; Water Products Division.
    - m. NIBCO INC.
    - n. Shurjoint Piping Products.
    - o. Troy Valve; a division of Penn-Troy Manufacturing, Inc.
    - p. Tyco Fire & Building Products LP.
    - q. United Brass Works, Inc.
    - r. U.S. Pipe.
    - s. Watts Water Technologies, Inc.
    - t. Or approved equal
  2. 250-psig, UL-Listed and FM-Approved, Iron, Nonrising-Stem Gate Valves:
    - a. Description: Iron body and bonnet, bronze seating material, and inside screw.
    - b. Standards: UL 262 and "Approval Guide," published by FM Global, listing.
    - c. Pressure Rating: 250 psig minimum.
    - d. End Connections: Mechanical or push-on joint.
    - e. Indicator-Post Flange: Include on valves used with indicator posts.
  3. 250-psig, UL-Listed and FM-Approved, Iron, OS&Y Gate Valves:
    - a. Description: Iron body and bonnet and bronze seating material.

- b. Standards: UL 262 and "Approval Guide," published by FM Global, listing.
  - c. Pressure Rating: 250 psig minimum.
  - d. End Connections: Flanged or grooved.
4. UL-Listed and FM-Approved, OS&Y Bronze, Gate Valves:
- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Crane Co.; Crane Valve Group; Crane Valves.
    - 2) Crane Co.; Crane Valve Group; Stockham Division.
    - 3) Milwaukee Valve Company.
    - 4) NIBCO INC.
    - 5) United Brass Works, Inc.
    - 6) Or approved equal
  - b. Description: Bronze body and bonnet and bronze stem.
  - c. Standards: UL 262 and "Approval Guide," published by FM Global, listing.
  - d. Pressure Rating: 250 psig minimum.
  - e. End Connections: Threaded.

## 2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

### A. Tapping-Sleeve Assemblies:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
  - b. Clow Valve Company; a division of McWane, Inc.
  - c. East Jordan Iron Works, Inc.
  - d. Flowserve.
  - e. Kennedy Valve; a division of McWane, Inc.
  - f. M&H Valve Company; a division of McWane, Inc.
  - g. Mueller Co.; Water Products Division.
  - h. U.S. Pipe.
  - i. Or approved equal
- 2. Description: Sleeve and valve compatible with drilling machine.
- 3. Standard: MSS SP-60.
- 4. Tapping Sleeve: Cast-iron, ductile-iron, or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Sleeve shall match size and type of pipe material being tapped and have recessed flange for branch valve.
- 5. Valve: AWWA, cast-iron, nonrising-stem, metal-seated gate valve with one raised-face flange mating tapping-sleeve flange.

- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

## 2.7 BACKFLOW PREVENTERS

- A. Double-Check, Backflow-Prevention Assemblies:
  1. Manufacturers: Subject to compliance with requirements, provide products by the following manufacturers:
    - a. Watts Water Technologies, Inc.
    - b. Or approved equal
  2. Standard: ASSE 1015 or AWWA C510.
  3. Basis of design product: Watts Model 709.
  4. Operation: Continuous-pressure applications unless otherwise indicated.
  5. Pressure Loss: 4.5 psi maximum at rated flow.
  6. Size: As indicated on drawings
  7. Body Material: cast iron with interior lining complying with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 and larger.
  8. End Connections: flanged for NPS 2-1/2 and larger.
  9. Configuration: Designed for horizontal, straight through flow.
  10. Accessories: OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Comply with excavating, trenching, and backfilling requirements in Division 31 "Earthwork."

### 3.2 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with water utility company for tap of size and in location indicated in water main.
- B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- C. Make connections larger than NPS 2 with tapping machine according to the following:
  1. Install tapping sleeve and tapping valve according to MSS SP-60.
  2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
  3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
  4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- D. Make connections NPS 2 and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company's standards.
  2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
  3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
  4. Install corporation valves into service-saddle assemblies.
  5. Install manifold for multiple taps in water main.
  6. Install curb valve in water-service piping with head pointing up and with service box.
- E. Comply with NFPA 24 for fire-service-main piping materials and installation.
- F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
1. Install encasement for piping according to ASTM A 674 or AWWA C105.
- G. Bury piping with depth of cover over top at least 60 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:
- H. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- I. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.
1. Terminate fire-suppression water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.
- J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports. Thrust blocks shall be installed in accordance with NFPA 24. Thrust blocks shall have a 28 day compressive strength of 3,000 psi in accordance with Section 033000, "Cast-in-Place Concrete."
- K. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- L. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

### 3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in tubing NPS 2 and smaller.
- C. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of tubes and remove burrs.
- E. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.
- F. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
- G. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.
- H. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.
- I. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.
- J. Do not use flanges or unions for underground piping.

### 3.4 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
  - 1. Concrete thrust blocks.
  - 2. Locking mechanical joints.
  - 3. Set-screw mechanical retainer glands.
  - 4. Bolted flanged joints.
  - 5. Heat-fused joints.
  - 6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:
  - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
  - 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
  - 3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

### 3.5 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL-Listed or FM-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- D. UL-Listed or FM-Approved Valves Other Than Gate Valves: Comply with NFPA 24.
- E. MSS Valves: Install as component of connected piping system.
- F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
- G. Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

### 3.6 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support NPS 2-1/2 and larger backflow preventers and piping on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

### 3.7 CONNECTIONS

- A. Connect fire-suppression water-service piping to utility water main. Use tapping sleeve and tapping valve.
- B. Connect fire-suppression water-service piping to interior fire-suppression piping.

### 3.8 FIELD QUALITY CONTROL

- A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.

- B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.
  - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to 0 psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- D. Prepare test and inspection reports.

### 3.9 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 334020 "Warning and Tracer Tape."
- B. Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.10 CLEANING

- A. Clean and disinfect fire-suppression water-service piping as follows:
  - 1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
  - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
  - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
    - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for three hours.
    - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.

- d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

### 3.11 PIPING SCHEDULE

- A. Underground fire-suppression water-service piping shall be the following:
  - 1. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern or ductile-iron, compact-pattern fittings; glands, gaskets, and bolts; and gasketed joints. Unless otherwise indicated or specified, ductile iron pipe shall be at least thickness Class 56.
  - 2. Inside of pipe and fittings shall be given a double thickness cement lining and bituminous seal coat in accordance with ANSI/AWWA C104/A21.4. The outside of pipe and fittings shall be coated with a standard bituminous coating conforming to ANSI/AWWA C151/A21.51 and C110/A21.10, respectively.

### 3.12 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
- B. Standard-pressure, aboveground and vault fire-suppression water-service shutoff valves NPS 3 and larger shall be one of the following:
  - 1. 250-psig, AWWA, iron, OS&Y, resilient-seated gate valves.
  - 2. AWWA or UL-listed or FM Global-approved butterfly valves.

End of Section



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Section 21 12 00

FIRE-SUPPRESSION STANDPIPES

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Cornell University Standards; request most up to date standards at the time of bid.

1.2 SUMMARY

A. Section Includes:

- 1. Pipes, fittings, and specialties.
- 2. Fire-protection valves.
- 3. Hose connections.
- 4. Hose stations.
- 5. Monitors.
- 6. Fire-department connections.
- 7. Alarm devices.
- 8. Manual control stations.
- 9. Control panels.
- 10. Pressure gages.

B. Related Sections:

- 1. Section 210517 "Sleeves and sleeve seals for fire-suppression piping".
- 2. Section 210518 "Escutcheons for fire-suppression piping".
- 3. Section 210553 "Identification for fire-suppression piping and equipment".
- 4. Section 211100 "Facility fire-suppression water-service piping".
- 5. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping".
- 6. Section 283111 "Digital, Addressable Fire-Alarm System".

1.3 DEFINITIONS

- A. High-Pressure Standpipe Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 300 psig.

#### 1.4 SYSTEM DESCRIPTIONS

- A. Manual Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has small water supply to maintain water in standpipes. Piping is wet, but water must be pumped into standpipes to satisfy demand.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. A Class I manual wet-pipe standpipe system shall be combined with the wet-pipe sprinkler system where indicated and shall be designed in accordance with the applicable codes and manufacturer's recommendations. All 2-1/2-inch hose connections shall be equipped with a cap attached with a chain. The threads shall be compatible with the fire department equipment. The contractor shall specifically confirm all thread requirements with the local fire department prior to fabrication. The standpipe system shall rely on the fire department connection to supply the system demand.
- B. Delegated Design: Design fire-suppression standpipes, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Fire-suppression standpipe design shall be approved by Cornell University's EHS/Fire Protection Engineer, FM Global and all authorities having jurisdiction.
  - 1. Minimum residual pressure at each hose-connection outlet is as follows:
    - a. NPS 2-1/2 Hose Connections: 100 psig
  - 2. Maximum residual pressure at required flow at each hose-connection outlet is as follows unless otherwise indicated:
    - a. NPS 2-1/2 Hose Connections: 175 psig
- D. Seismic Performance: Fire-suppression standpipes shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

#### 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For fire-suppression standpipes. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For standpipe systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Fire-suppression standpipes, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Domestic water piping.
  - 2. HVAC hydronic piping.
- B. Qualification Data: For qualified Installer and professional engineer.
- C. Approved Standpipe Drawings: Working plans, prepared according to NFPA 14, that have been approved by Cornell University's EHS/Fire Protection Engineer, FM Global and all authorities having jurisdiction, including hydraulic calculations.
- D. Welding certificates.
- E. Fire-hydrant flow test report.
- F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- G. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-suppression standpipes specialties to include in emergency, operation, and maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression standpipes and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. 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.

- D. NFPA Standards: Fire-suppression standpipe equipment, specialties, accessories, installation, and testing shall comply with NFPA 14, "Installation of Standpipe and Hose Systems."

#### 1.10 PROJECT CONDITIONS

- A. Interruption of Existing Fire-Suppression Standpipe Service: Do not interrupt fire-suppression standpipe service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fire-suppression standpipe service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of fire-suppression standpipe service.
  - 2. Do not proceed with interruption of fire-suppression standpipe service without Owner's written permission.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.
- B. All materials and pipe joining methods shall be UL-listed and FM-approved.

#### 2.2 STEEL PIPE AND FITTINGS

- A. Schedule 40, Black-Steel Pipe: ASTM A 53/A 53M, Type F, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- C. Uncoated, Steel Couplings: ASTM A 865, threaded.
- D. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 150, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Cast-Iron Flanges: ASME B16.1, Class 150.
- G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- H. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
- I. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Anvil International, Inc.
  - b. Corcoran Piping System Co.
  - c. National Fittings, Inc.
  - d. Shurjoint Piping Products.
  - e. Tyco Fire & Building Products LP.
  - f. Victaulic Company.
2. Pressure Rating: 250 psig minimum as required.
3. Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

### 2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
  1. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

### 2.4 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
  1. Valves shall be UL listed or FM approved.
  2. Minimum Pressure Rating for High-Pressure Piping: 250 psig.
- B. Ball Valves:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Anvil International, Inc.
    - b. Victaulic Company.
  2. Standard: UL 1091 except with ball instead of disc.
  3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
  4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
  5. Valves NPS 3: Ductile-iron body with grooved ends.
- C. Bronze Butterfly Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fivalco Inc.
    - b. Global Safety Products, Inc.
    - c. Milwaukee Valve Company.
  2. Standard: UL 1091.
  3. Pressure Rating: 250 psig.
  4. Body Material: Bronze.
  5. End Connections: Threaded.
- D. Iron Butterfly Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Anvil International, Inc.
    - b. Fivalco Inc.
    - c. Global Safety Products, Inc.
    - d. Kennedy Valve; a division of McWane, Inc.
    - e. Milwaukee Valve Company.
    - f. NIBCO INC.
    - g. Pratt, Henry Company.
    - h. Shurjoint Piping Products.
    - i. Tyco Fire & Building Products LP.
    - j. Victaulic Company.
  2. Standard: UL 1091.
  3. Pressure Rating: 250 psig.
  4. Body Material: Cast or ductile iron.
  5. Style: Lug or wafer.
  6. End Connections: Grooved.
- E. Check Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Kennedy Valve; a division of McWane, Inc.
  - b. Mueller Co.; Water Products Division.
  - c. Viking Corporation.
2. Standard: UL 312.
  3. Pressure Rating: 250 psig minimum Type: Swing check.
  4. Body Material: Cast iron.
  5. End Connections: Flanged or grooved.
  6. Faceplate: Removable.
- F. Bronze OS&Y Gate Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Stockham Division.
    - c. Milwaukee Valve Company.
    - d. NIBCO INC.
    - e. United Brass Works, Inc.
  2. Standard: UL 262.
  3. Pressure Rating: 250 psig.
  4. Body Material: Bronze.
  5. End Connections: Threaded.
- G. Iron OS&Y Gate Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
    - b. American Valve, Inc.
    - c. Clow Valve Company; a division of McWane, Inc.
    - d. Crane Co.; Crane Valve Group; Crane Valves.
    - e. Crane Co.; Crane Valve Group; Jenkins Valves.
    - f. Crane Co.; Crane Valve Group; Stockham Division.
    - g. Hammond Valve.
    - h. Milwaukee Valve Company.
    - i. Mueller Co.; Water Products Division.
    - j. NIBCO INC.
    - k. Shurjoint Piping Products.
    - l. Tyco Fire & Building Products LP.
    - m. United Brass Works, Inc.
    - n. Watts Water Technologies, Inc.
  2. Standard: UL 262.
  3. Pressure Rating: 250 psig minimum
  4. Body Material: Cast or ductile iron.
  5. End Connections: Flanged or grooved.



H. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Anvil International, Inc.
  - b. Fivalco Inc.
  - c. Global Safety Products, Inc.
  - d. Kennedy Valve; a division of McWane, Inc.
  - e. Milwaukee Valve Company.
  - f. NIBCO INC.
  - g. Shurjoint Piping Products.
  - h. Tyco Fire & Building Products LP.
  - i. Victaulic Company.
2. Standard: UL 1091.
3. Pressure Rating: 250 psig minimum.
4. Valves NPS 2 and Smaller:
  - a. Valve Type: Ball or butterfly.
  - b. Body Material: Bronze.
  - c. End Connections: Threaded.
5. Valves NPS 2-1/2 and Larger:
  - a. Valve Type: Butterfly.
  - b. Body Material: Cast or ductile iron.
  - c. End Connections: Flanged, grooved, or wafer.
6. Valve Operation: Integral electrical, 115-V ac, prewired, two-circuit, supervisory switch visual indicating device.

I. NRS Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
  - b. American Valve, Inc.
  - c. Clow Valve Company; a division of McWane, Inc.
  - d. Crane Co.; Crane Valve Group; Stockham Division.
  - e. Kennedy Valve; a division of McWane, Inc.
  - f. Mueller Co.; Water Products Division.
  - g. NIBCO INC.
  - h. Tyco Fire & Building Products LP.
2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast iron with indicator post flange.
5. Stem: Nonrising.

6. End Connections: Flanged or grooved.

J. Indicator Posts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
  - b. American Valve, Inc.
  - c. Clow Valve Company; a division of McWane, Inc.
  - d. Crane Co.; Crane Valve Group; Stockham Division.
  - e. Kennedy Valve; a division of McWane, Inc.
  - f. Mueller Co.; Water Products Division.
  - g. NIBCO INC.
  - h. Tyco Fire & Building Products LP.
2. Standard: UL 789.
3. Type: Horizontal for wall mounting.
4. Body Material: Cast iron with extension rod and locking device.
5. Operation: Hand wheel.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 250 psig minimum as required.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Fire Protection Products, Inc.
  - b. United Brass Works, Inc.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Affiliated Distributors.
  - b. Anvil International, Inc.
  - c. Barnett.
  - d. Conbraco Industries, Inc.; Apollo Valves.
  - e. Fire-End & Croker Corporation.
  - f. Fire Protection Products, Inc.

- g. Flowserve.
- h. FNW.
- i. Jomar International, Ltd.
- j. Kennedy Valve; a division of McWane, Inc.
- k. Kitz Corporation.
- l. Legend Valve.
- m. Metso Automation USA Inc.
- n. Milwaukee Valve Company.
- o. NIBCO INC.
- p. Potter Roemer.
- q. Red-White Valve Corporation.
- r. Southern Manufacturing Group.
- s. Stewart, M. A. and Sons Ltd.
- t. Tyco Fire & Building Products LP.
- u. Victaulic Company.
- v. Watts Water Technologies, Inc.

D. Globe Valves:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Fire Protection Products, Inc.
  - b. United Brass Works, Inc.

E. Plug Valves:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Southern Manufacturing Group.

## 2.6 SPECIALTY VALVES

A. General Requirements:

- 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
- 2. Pressure Rating:
  - a. High-Pressure Piping Specialty Valves: 250 psig
- 3. Body Material: Cast or ductile iron.
- 4. Size: Same as connected piping.
- 5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. AFAC Inc.
  - b. Globe Fire Sprinkler Corporation.
  - c. Reliable Automatic Sprinkler Co., Inc.
  - d. Tyco Fire & Building Products LP.
  - e. Venus Fire Protection Ltd.
  - f. Victaulic Company.
  - g. Viking Corporation.
2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. AFAC Inc.
  - b. Reliable Automatic Sprinkler Co., Inc.
  - c. Tyco Fire & Building Products LP.
2. Standard: UL 1726.
3. Pressure Rating: 250 psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.7 HOSE CONNECTIONS

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Elkhart Brass Mfg. Company, Inc.
  - b. Fire-End & Croker Corporation.
  - c. Guardian Fire Equipment, Inc.
  - d. NIBCO INC.
  - e. Potter Roemer.
  - f. Tyco Fire & Building Products LP.
2. Standard: UL 668 hose valve, with integral UL 1468 reducing or restricting pressure-control device, for connecting fire hose.
3. Pressure Rating: 300 psig minimum.

4. Material: Brass or bronze.
5. Size: NPS 1-1/2 or NPS 2-1/2, as indicated.
6. Inlet: Female pipe threads.
7. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.
8. Pattern: Angle.
9. Pressure Loss: Maximum 3.5 psi at 250 gpm.
10. Finish: Polished chrome plated.

## 2.8 FIRE-DEPARTMENT CONNECTIONS

- A. Exposed-Type, 5-inch Storz, Fire-Department Connection, UL listed and FM approved:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. AFAC Inc.
    - b. Elkhart Brass Mfg. Company, Inc.
    - c. Fire-End & Croker Corporation.
    - d. Fire Protection Products, Inc.
    - e. GMR International Equipment Corporation.
    - f. Guardian Fire Equipment, Inc.
    - g. Tyco Fire & Building Products LP.
    - h. Reliable Automatic Sprinkler Co., Inc.
    - i. Potter-Roemer, Fire Protection Division.
  2. Standard: UL 405.
  3. Type: Exposed, projecting, for wall mounting.
  4. Pressure Rating: 250 psig.
  5. Body Material: Corrosion-resistant metal.
  6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
  7. Caps: Brass, lugged type, with gasket and chain.
  8. Escutcheon Plate: Round, brass, wall type.
  9. Outlet: Back, with pipe threads.
  10. Number of Inlets: Two
  11. Escutcheon Plate Marking: Similar to "**AUTO SPKR & STANDPIPE.**" Owner to confirm exact marking to reflect the areas of the building being served.
  12. Finish: Polished chrome plated
  13. Outlet Size: 5-inches.
- B. Flush-Type, 5-inch Storz, Fire-Department Connection, UL-listed and FM Global approved:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. AFAC Inc.
    - b. Elkhart Brass Mfg. Company, Inc.

- c. GMR International Equipment Corporation.
  - d. Guardian Fire Equipment, Inc.
  - e. Reliable Automatic Sprinkler Co., Inc.
  - f. Potter-Roemer, Fire Protection Division
2. Standard: UL 405.
  3. Type: Flush mounted, Storz.
  4. Pressure Rating: 250 psig minimum.
  5. Body Material: Corrosion-resistant metal.
  6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
  7. Caps: Brass, lugged type, with gasket and chain.
  8. Escutcheon Plate: Rectangular, brass, wall type.
  9. Outlet: With pipe threads.
  10. Escutcheon Plate Marking: Similar to "**AUTO SPKR & STANDPIPE.**" Owner to confirm exact marking to reflect the areas of the building being served.
  11. Finish: Polished chrome plated
  12. Outlet Size: **NPS 5.**

## 2.9 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm Bell:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fire-Lite Alarms, Inc.; a Honeywell company.
    - b. Notifier; a Honeywell company.
    - c. Potter Electric Signal Company.
  2. Standard: UL 464.
  3. Type: Vibrating, metal alarm bell.
  4. Size: **8-inch** minimum diameter.
  5. Finish: Red-enamel factory finish, suitable for outdoor use.
- C. Water-Flow Indicators:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Potter Electric Signal Company.
  2. Description: UL-listed and FM Global approved Vane type waterflow switch with electronic retard and auto test feature.

3. Water-Flow Detector: Model VSR-AT with two sets of alarm contacts and adjustable instantly recycling electronic retard.
4. Components: Auto test control model ATC-1
5. Service Pressure Rating: 450 psig.
6. Design Installation: Horizontal or vertical.

D. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. AFAC Inc.
  - b. Barksdale, Inc.
  - c. Detroit Switch, Inc.
  - d. Potter Electric Signal Company.
  - e. System Sensor; a Honeywell company.
  - f. Tyco Fire & Building Products LP.
  - g. United Electric Controls Co.
  - h. Viking Corporation.
2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Fire-Lite Alarms, Inc.; a Honeywell company.
  - b. Kennedy Valve; a division of McWane, Inc.
  - c. Potter Electric Signal Company.
  - d. System Sensor; a Honeywell company.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

F. Indicator-Post Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Potter Electric Signal Company.
  - b. System Sensor; a Honeywell company.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled indicator-post valve is in other than fully open position.

#### 2.10 MANUAL CONTROL STATIONS

- A. Description: UL listed and FM approved, hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

#### 2.11 CONTROL PANELS

- A. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire-alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.
  1. Panels: UL listed and FM approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
  2. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
  3. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

#### 2.12 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. AMETEK; U.S. Gauge Division.
  2. Ashcroft Inc.
  3. Brecco Corporation.
  4. WIKA Instrument Corporation.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: **0 to 250 psig** minimum



- E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Perform fire-hydrant flow test according to NFPA 14 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

#### **3.2 EXAMINATION**

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.3 SERVICE-ENTRANCE PIPING**

- A. Connect fire-suppression standpipe piping to water-service piping at service entrance into building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping."
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories at connection to fire-suppression water-service piping. Comply with requirements for backflow preventers in Section 211100 "Facility Fire-Suppression Water-Service Piping."
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

#### **3.4 PIPING INSTALLATION**

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

- B. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-suppression standpipe piping.
- C. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.
- D. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install drain valves on standpipes. Extend drain piping to outside of building.
- F. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.
- G. Install alarm devices in piping systems.
- H. Install hangers and supports for standpipe system piping according to NFPA 14. Comply with requirements in NFPA 13 for hanger materials.
- I. Install pressure gages on riser or feed main and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- J. Fill wet-type standpipe system piping with water.
- K. Install electric heating cables and pipe insulation on wet-type, fire-suppression standpipe piping in areas subject to freezing. Comply with requirements for heating cables in Section 210533 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 210700 "Fire-Suppression Systems Insulation."
- L. Connect compressed-air supply to dry-pipe sprinkler piping.
- M. Connect air compressor to the following piping and wiring:
  - 1. Pressure gages and controls.
  - 2. Electrical power system.
  - 3. Fire-alarm devices, including low-pressure alarm.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

### 3.5 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
  - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- K. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- L. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- M. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.6 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 14 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
  - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
  - 2. Alarm Valves: Install bypass check valve and retarding chamber drain-line connection.

### 3.7 HOSE-CONNECTION INSTALLATION

- A. Install hose connections adjacent to standpipes.
- B. Install freestanding hose connections for access and minimum passage restriction.
- C. Install NPS 2-1/2 hose connections.
- D. Install two hose connections at top of most hydraulically remote standpipe for testing purposes.
- E. Install wall-mounted-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Section 104413 "Fire Protection Cabinets."

### 3.8 MONITOR INSTALLATION

- A. Install monitors on standpipe piping.

### 3.9 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire-department connections.
- B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.10 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
  - 4. Coordinate Standpipe flow test with CU EHS/IFD as well as one of IFD's engine.
  - 5. Energize circuits to electrical equipment and devices.
  - 6. Start and run air compressors.
  - 7. Coordinate with fire-alarm tests. Operate as required.
  - 8. Coordinate with fire-pump tests. Operate as required.
  - 9. Verify that equipment hose threads are same as local fire-department equipment.
- C. Fire-suppression standpipe system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.12 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.13 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: black-steel, schedule 40 steel, type F or type S pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- B. Standard-pressure, wet-type, fire-suppression standpipe piping, **NPS 2** and smaller, shall be the following:
  - 1. Schedule 40 black-steel, type F or type S pipe with cast or malleable-iron threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

- C. Standard-pressure, wet-type, fire-suppression standpipe piping, **NPS 2-1/2 and larger**, shall be the following:
  - 1. Schedule 40 black-steel, type F or type S pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

End of Section

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Section 21 13 13

WET-PIPE SPRINKLER SYSTEMS

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Pipes, fittings, and specialties.
- 2. Fire-protection valves.
- 3. Sprinklers.
- 4. Pressure gages.

B. Related Sections:

- 1. Section 210517 "Sleeves and sleeve seals for fire-suppression piping."
- 2. Section 210518 "Escutcheons for fire-suppression piping"
- 3. Section 210553 "Identification for fire-suppression piping and equipment"

1.3 APPLICABLE CODES AND STANDARDS

- A. The specifications and standards listed below form a part of this section of the specifications. The system shall fully comply with the latest issue, with all updates, of these standards as applicable. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

- 1. New York State Codes and Regulations
  - a. New York State Uniform Fire Prevention and Building Code.
- 2. NFPA Standards
  - a. NFPA 13, Standard for the Installation of Sprinkler Systems
  - b. NFPA 14, Standard for the Installation of Standpipe and Hose Systems
  - c. NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection
  - d. NFPA 24, Standard for the Installation of Private Service Mains and Their Appurtenances
  - e. NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems
  - f. NFPA 30, Flammable and Combustible Liquids Code
  - g. NFPA 72, National Fire Alarm and Signaling Code
- 3. Americans with Disabilities Act and Architectural Barriers Act
  - a. Accessibility Guidelines



4. FM Global Datasheets and Forms
  - a. 2-0, *Installation Guidelines for Automatic Sprinklers*
  - b. 3-0, *Hydraulics of Fire Protection Systems*
  - c. 3-26, *Fire Protection Water Demand for Non-Storage Sprinklered Occupancies*
  - d. Form 85A, *Contractor's Material and Test Certificate for Automatic Sprinkler System*

#### DEFINITIONS

- A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 300 psig.

#### 1.5 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

#### 1.6 PERFORMANCE REQUIREMENTS

- A. The automatic sprinkler system shall be designed in accordance with all required and recommended provisions of NFPA 13, FM Global and manufacturer requirements. The sprinkler system shall be hydraulically calculated to meet the minimum density and pressure requirements per NFPA 13 and FM Global. The system installation shall include all necessary components, materials, accessories and equipment in order to complete a working, functional and code compliant system.
- B. An automatic wet-pipe standpipe system shall be combined with the wet-pipe sprinkler system where indicated and shall be designed in accordance with the applicable codes and manufacturer's recommendations.
- C. The sprinkler system installation shall be fully coordinated with all other trades and disciplines. Sprinklers shall be located in accordance with NFPA 13, FM Global and manufacturer's requirements and recommendations. Sprinkler locations shall be coordinated with all architectural, mechanical, electrical and other building components and equipment.
- D. Sprinkler piping shall be sized to provide the specified density when the system is discharging over the total maximum discharge area as required by NFPA 13 and FM Global for the protected hazard classification.
- E. The contractor shall be required to perform a water flow and fire pump flow tests in coordination with Cornell as part of this contract that will establish the available water supply capacity for the sprinkler system. The water supply test and fire pump flow test shall establish the available flow and pressure at the point of connection to the building sprinkler system. The results of the flow test reports shall be utilized for all system design. Obtain all permits, and notify the owner and owner's representative no fewer than 3 days prior to the scheduled date of testing.

- F. The sprinkler system shall be hydraulically calculated in accordance with NFPA 13 and FM Global Datasheet 3-0.
- G. High-Pressure Piping System Component: Listed for 250-psig working pressure, but not higher than 300 psig.
- H. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- I. Sprinkler system and standpipe system design shall be approved by Cornell EHS/FP Engineer, FM Global and authorities having jurisdiction.
  - 1. Sprinkler Occupancy Hazard Classifications:
    - a. Refer to Contract Drawings
  - 2. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. Refer to Contract Drawings, NFPA 13 and FM Global requirements
  - 3. Maximum Protection Area per Sprinkler: Per UL listing, NFPA 13 and FM Global requirements.
  - 4. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 and FM Global:
    - a. Light Hazard (HC-1) Occupancies: 250 gpm for 60 minutes
    - b. Ordinary Hazard Group I (HC-2) Occupancies: 250 gpm for 60 minutes
    - c. Ordinary Hazard Group II (HC-3) Occupancies: 500 gpm for 90 minutes
- J. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.
- K. The extent of the system work is mostly shown on the Contract Drawings and contained in the Specifications. Contract Drawings are diagrammatic and indicate general arrangement of systems and work included. The Specifications supplement the drawings and include items of work which are not detailed on the drawings. Submission of a proposal shall be evidence that the contractor has reviewed all of the Contract Documents and performed all necessary visits to determine the complete scope of work.
- L. The system shall be installed mostly as shown on the Contract Documents with design criteria as specified in this Section. This specification requires the Contractor to prepare and submit drawings, system schematics and any other documents needed for the procurement of approvals and the provision of a complete, functional and approved system. As a result, the Contract Drawings serve the purpose of indicating design criteria for the Contractor's use and guidance in preparing the required submittal documents for review.
- M. The contract drawings and specifications form complimentary requirements. Provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials necessary for a sound, secure, complete and approved installation. Completely coordinate work of this specification with work of other trades and existing conditions.

- N. The Contractor is directed to bring to the attention of the Engineer, in writing, any discrepancies, deficiencies and/or other matters as they may relate to existing conditions, codes, standards, recommendations and/or job conditions. Failure of the Contractor to do so prior to bidding shall indicate acceptance of all documents herein and all job conditions.
- O. The Contractor shall bring to the attention of the Engineer any conflicts between these drawings and codes or standards for resolution.
- P. Should the Contractor perform any work that does not comply with the requirements of the specifications, drawings and applicable codes, standards and references, the Contractor shall bear all costs arising in correcting the work to the satisfaction of the Engineer and owner.
- Q. All materials, devices, and pipe joining methods shall be UL-listed and FM Global approved.

#### 1.7 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 1. Partial submittals will not be acceptable and will be returned without review.
  - 2. Latest published manufacturer's data sheets; installation instructions; and inspection, testing, and maintenance document shall be provided in both hard copy and electronic copy.
  - 3. Data sheets shall include the specific make and model of the equipment being provided. Where more than one model is included on the documents, the contractor shall clearly indicate which model is being submitted. If the model is not clearly marked, the equipment submittal may be rejected.
- B. Shop Drawings: For wet-pipe sprinkler systems and fire suppression standpipe systems. Include plans, elevations, sections, details, and attachments to other work. Submit detailed shop drawings, in accordance with NFPA 13 "Working Plans." Information shall include but is not be limited to the following:
  - 1. Layout indicating details, plan view, elevations and sections of the system piping. Indicate the location of sprinklers and piping in relation to the ceiling layout, showing pipe lengths and sizes. Most recent reflected ceiling plans shall be utilized and provided on the shop drawings. Show locations of all sleeves used in fire protection systems.
  - 2. Detailed riser diagram showing a schematic of system supply, supply connection, devices, valves, pipe and fittings.
  - 3. Wiring Diagrams: For power, signal, and control wiring.
- C. Hydraulic calculations: Provide hydraulic calculations in accordance with NFPA 13, NFPA 14, and FM Global Datasheet 3-0, and with the following:
  - 1. Conduct hydraulic water flow test in accordance with "Performance Requirements" article.
  - 2. Hydraulic calculations shall be computer generated. The name of the hydraulic program shall be provided. Methods using Microsoft Excel or other spreadsheet type software programs will not be acceptable.

3. Where the remote area is not evident, additional hydraulic calculations shall be submitted.
  4. Minimum operating pressure of any sprinkler shall be in accordance with NFPA 13, Listing and manufacturers installation instructions.
  5. Where multiple risers serve a floor plan and are looped, hydraulic calculations are required to consider the required flow from only one riser. Hydraulic calculations will not be accepted where flow is split through multiple risers.
  6. All hydraulic reference points shall be clearly identified and indicated on the shop drawings. An isometric and/or riser diagram shall be submitted to indicate all vertical connections between reference points.
  7. Margin of Safety for Available Water Flow and Pressure for Standpipes: 10psi including losses through water-service piping, valves, and backflow preventers.
  8. Velocities in piping shall not exceed 15 feet per second in sections that have paddle type flow switches.
- D. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Domestic water piping.
  2. Compressed air piping.
  3. HVAC hydronic piping.
  4. Items penetrating finished ceiling include the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
  5. Fire alarm system
- F. Qualification Data: For qualified Installer and professional engineer.
- G. Approved Sprinkler Piping and Standpipe Drawings: Working plans, prepared according to NFPA 13 and NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- H. Welding certificates.
- I. Fire-hydrant flow test report.
- J. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- K. Field quality-control reports.
- L. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
  - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer. Shop drawings and hydraulic calculations shall be stamped by a qualified professional engineer.

B. The Contractor shall furnish and install fire suppression system materials that are "Approved," "Identified," "Labeled," and "Listed" by a Nationally Recognized Testing Laboratory (NRTL) as suitable for the intended use. Any equipment and materials that are not NRTL "Approved," "Identified," "Labeled," and "Listed" that is installed by the contractor shall be removed and replaced at the contractor's expense.

C. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed for use as part of a fire suppression system. The contractor shall be responsible for the satisfactory installation of the complete system.

D. Each component of the fire suppression system shall be UL listed or approved. All components shall be installed in accordance with their specific listing and/or approval criteria. All equipment shall be installed in accordance with the manufacturer's recommendations and requirements.

E. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

F. 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.

G. NFPA Standards: Sprinkler and fire suppression standpipe system equipment, specialties, accessories, installation, and testing shall comply with applicable NFPA standards.

1.9 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Coordinate fire suppression standpipes and hose connections with all required means of egress. All required widths for the means of egress shall be maintained and shall not be encroached upon by fire suppression standpipes or hose connections.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.
2. Special Tools: The Contractor shall supply the Owner with two complete sets of special tools and equipment necessary to perform routine maintenance on the sprinkler system.

## **PART 2 - PRODUCTS**

### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.
- B. All materials and pipe joining methods shall be UL-listed and FM Global approved.

### 2.2 STEEL PIPE AND FITTINGS

- A. Schedule 40, Black-Steel Pipe: ASTM A 53/A 53M, Type F, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- C. Uncoated, Steel Couplings: ASTM A 865, threaded.
- D. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 250, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Cast-Iron Flanges: ASME 16.1, Class 250.
- G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- H. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
- I. Grooved-Joint, Steel-Pipe Appurtenances:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Anvil International, Inc.
    - b. Tyco Fire & Building Products LP.
    - c. Victaulic Company.
  2. Pressure Rating: 250 psig minimum as required.

3. Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

### 2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
  1. Class 250, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
  2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

### 2.4 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
  1. Valves shall be UL listed and FM Global approved.
  2. Minimum Pressure Rating for High-Pressure Piping: 250 psig
- B. Ball Valves:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Anvil International, Inc.
    - b. Fivalco Inc.
    - c. Victaulic Company.
    - d. Or approved equal
  2. Standard: UL 1091 except with ball instead of disc.
  3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
  4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
  5. Valves NPS 3: Ductile-iron body with grooved ends.
- C. Check Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Anvil International, Inc.
  - b. Milwaukee Valve Company.
  - c. Potter Roemer.
  - d. Reliable Automatic Sprinkler Co., Inc.
  - e. Tyco Fire & Building Products LP.
  - f. Victaulic Company.
  - g. Viking Corporation.
  - h. Or approved equal
2. Standard: UL 312.
3. Pressure Rating: 250 psig minimum.
4. Type: Swing check with removable face plate.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

## 2.5 TRIM AND DRAIN VALVES

### A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approved Guide", published by FM Global listing.
2. Pressure Rating: 250 psig minimum as required.

### B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Fire Protection Products, Inc.
  - b. United Brass Works, Inc.
  - c. Or approved equal

### C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Anvil International, Inc.
  - b. Kennedy Valve; a division of McWane, Inc.
  - c. Milwaukee Valve Company.
  - d. NIBCO INC.
  - e. Potter Roemer.
  - f. Tyco Fire & Building Products LP.
  - g. Victaulic Company.
  - h. Watts Water Technologies, Inc.
  - i. Or approved equal

### D. Globe Valves:



1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Fire Protection Products, Inc.
  - b. United Brass Works, Inc.
  - c. Or approved equal

## 2.6 SPECIALTY VALVES

### A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approved Guide", published by FM Global listing.
2. Pressure Rating:
  - a. High-Pressure Piping Specialty Valves: 250 psig
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

### B. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. AFAC Inc.
  - b. Reliable Automatic Sprinkler Co., Inc.
  - c. Tyco Fire & Building Products LP.
  - d. Or approved equal
2. Standard: UL 1726.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4
5. End Connections: Threaded.

### C. Automatic Air Release Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Potter Electric Signal Company, LLC.
  - b. Reliable Automatic Sprinkler Co., Inc.
  - c. AGF, Inc.
  - d. Or approved equal
2. Description: The automatic air release valve shall consist of a 40 mesh "Y" type strainer connected to an automatic air vent valve. The output of the air vent valve shall be piped to a secondary automatic shut off valve, (WAGS). The WAGS shall be factory installed in a water retention pan. In the event the primary automatic air vent fails to close and water begins to discharge, the water will flow through the

WAGS and into the water retention pan. When the water level in the retention pan reaches a pre-determined level, a water-soluble element in the WAGS shall dissolve and release a powerful spring-loaded piston to provide a positive water shutoff. Operation of the WAGS shall activate a switch capable of being monitored by a fire alarm panel or remote indicator. The air vent assembly and/or WAGS shall be field replaceable without disabling the sprinkler system by the installation of a separate ½" ball valve installed before the Y strainer for isolation purposes. The automatic air release valve shall be mounted in a vertical position and shall require a minimum of 8-inches of clearance above the fire sprinkler main or branch line piping. Furnish and install a ball valve prior to the "Y" type strainer to isolate the automatic air release valve and strainer from the system for replacement of the automatic air vent or WAGS or strainer maintenance.

3. Body Material: Brass.
4. Size: As required to match connected piping.
5. End Connections: Threaded.

## 2.7 SPRINKLER SPECIALTY PIPE FITTINGS

### A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Anvil International, Inc.
  - b. National Fittings, Inc.
  - c. Shurjoint Piping Products.
  - d. Tyco Fire & Building Products LP.
  - e. Victaulic Company.
  - f. Or approved equal
2. Standard: UL 213.
3. Pressure Rating: 250 psig minimum as required.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Solid back strap only, rolled steel strap types not permitted. Ductile-iron housing with branch outlets. Snap-on and strapless not permitted.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

### B. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Elkhart Brass Mfg. Company, Inc.
  - b. Fire-End & Croker Corporation.
  - c. Potter Roemer.
  - d. Or approved equal

2. Standard: UL 199.
  3. Pressure Rating: 250 psig minimum as required.
  4. Body Material: Brass.
  5. Size: Same as connected piping.
  6. Inlet: Threaded.
  7. Drain Outlet: Threaded and capped.
  8. Branch Outlet: Threaded, for sprinkler.
- C. Sprinkler Inspector's Test Fittings:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. AGF Manufacturing Inc.
    - b. Triple R Specialty.
    - c. Tyco Fire & Building Products LP.
    - d. Victaulic Company.
    - e. Viking Corporation.
    - f. Or approved equal
  2. Standard: UL's "Fire Protection Equipment Directory" listing.
  3. Pressure Rating: 250 psig minimum as required
  4. Body Material: Cast- or ductile-iron housing with sight glass and pressure relief valve.
  5. Size: Same as connected piping.
  6. Inlet and Outlet: Threaded.
- D. Adjustable Drop Nipples:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. CECA, LLC.
    - b. Corcoran Piping System Co.
    - c. Merit Manufacturing; a division of Anvil International, Inc.
    - d. Or approved equal
  2. Standard: UL 1474.
  3. Pressure Rating: 250 psig minimum
  4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
  5. Size: Same as connected piping.
  6. Length: Adjustable.
  7. Inlet and Outlet: Threaded.
- E. Flexible, Sprinkler Hose Fittings:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fivalco Inc.
    - b. FlexHead Industries, Inc.
    - c. Gateway Tubing, Inc.

- d. Or approved equal
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 250 psig minimum as required
5. Size: Same as connected piping, for sprinkler.

## 2.8 SPRINKLERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide sprinklers manufactured by Viking Corporation. If required products are not available from basis-of-design manufacturer, available manufacturers offering products that may be incorporated into the Work upon approval include, but are not limited to, the following:
  1. Tyco Fire & Building Products LP.
  2. Victaulic Company.
  3. Reliable Automatic Sprinkler Co, Inc.
  4. Or approved equal.
- B. General Requirements:
  1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approved Guide", published by FM Global listing.
  2. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig.
- C. Automatic Sprinklers with Heat-Responsive Element:
  1. Nonresidential Applications: UL 199
  2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K as indicated in contract documents, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes:
  1. Chrome plated.
  2. Bronze.
  3. Painted.
- E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  1. Ceiling Mounting: chrome-plated steel, painted white, one piece, flat.
  2. Sidewall Mounting: chrome plated steel, painted white, one piece, flat.
- F. Sprinkler Guards:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Reliable Automatic Sprinkler Co., Inc.
    - b. Tyco Fire & Building Products LP.
    - c. Victaulic Company.

- d. Viking Corporation.
  - e. Or approved equal
- 2. Standard: UL 199, specifically listed with the sprinkler.
  - 3. Type: Wire cage with fastening device for attaching to sprinkler.

## 2.9 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AMETEK; U.S. Gauge Division.
  - 2. Ashcroft, Inc.
  - 3. Brecco Corporation.
  - 4. WIKA Instrument Corporation.
  - 5. Or approved equal
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0 to 250 psig minimum
- E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
- F. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Perform fire-hydrant and fire pump flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

### 3.2 EXAMINATION

- A. Examine roughing-in for hose connections to verify actual locations of piping connections before installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler and standpipe piping in NFPA 13 and NFPA 14.
- C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install alarm devices in piping systems.
- I. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- J. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal and install where they will not be subject to freezing.
- K. Fill sprinkler system piping with water.
- L. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- M. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- N. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

### 3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
  - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- M. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Install Butterfly Valves designed to be Supervised Closed as indicated on the drawings or for fire pump test headers, roof manifold valves or other valves intended to remain normally closed. These valves shall not be installed where water flow is required for normal system operation.

3.6 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels. Refer to contract drawings for details.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Sprinklers shall be furnished and installed to conform to manufacturer's listing.
- D. All sprinklers shall be coordinated with a final reflected ceiling plan and existing conditions to arrive at a suitable pattern consistent with proper sprinkler protection.
- E. Where used, install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.
- F. Sprinklers shall be handled, installed, delivered and stored in accordance with manufacturer's requirements. Sprinklers shall not be subject to temperatures in excess of 100 °F. Glass bulb sprinklers shall have their bulb protectors removed at the time the system is placed in service for fire protection.

3.7 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14. Comply with requirements for identification specified in Section 210553 – "Identification for Fire-Suppression Piping and Equipment."
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."



3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Leak Test: After installation, charge systems and test for leaks in accordance with NFPA 13 and NFPA 14. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Flush, test and inspect standpipe systems according to NFPA 14, "System Acceptance" chapter.
  - 5. Energize circuits to electrical equipment and devices.
  - 6. Coordinate with fire-alarm tests. Operate as required.
  - 7. Coordinate with fire-pump tests. Operate as required.
  - 8. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system and fire suppression standpipe system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports. Complete "Contractor's Material and Test Certificate" and prepare a general information sign in accordance with NFPA 13.
- E. Schedule final acceptance test with Cornell EHS and IFD.

3.9 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

3.11 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, schedule 40 steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller shall be the following:

1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger shall be the following:
1. Schedule 40 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

### 3.12 SPRINKLER SCHEDULE

- A. Provide the following sprinkler types unless otherwise noted on the contract drawings:
1. Rooms without Ceilings: Upright sprinklers
  2. Rooms with Suspended Ceilings: Concealed sprinklers.
  3. Wall Mounting: Sidewall sprinklers.
  4. Spaces Subject to Freezing: Upright or pendent dry sprinklers; and sidewall dry sprinklers as indicated
  5. Provide quick response sprinklers in all light and ordinary hazard occupancies, and all other occupancies in which their use is listed or approved.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted cover plate. Refer to architectural drawings for required finishes.
  2. Recessed Sprinklers: Unless otherwise indicated in architectural drawings, factory finished white, with factory finished white recessed escutcheon.
  3. Upright, Pendent and Sidewall Sprinklers: Unless otherwise indicated in architectural drawings, chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

End of Section

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Section 21 13 16

DRY-PIPE AND PRE-ACTION SPRINKLER SYSTEMS

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinkler specialty pipe fittings.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.
9. Nitrogen Generation System

B. Related Requirements:

1. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.
2. Section 283111 "Digital Addressable Fire-Alarm System" for alarm devices not specified in this section.

1.3 DEFINITIONS

- A. High-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 250-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For dry-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

- C. Delegated-Design Submittal: For dry-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Domestic water piping.
  - 2. Compressed air piping.
  - 3. HVAC hydronic piping.
  - 4. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. All other ceiling mounted fixtures or devices.
- B. Qualification Data: For qualified Installer and professional engineer.
- C. Design Data:
  - 1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by Cornell University's EHS/Fire Protection Engineer, FM Global and all authorities having jurisdiction, including hydraulic calculations if applicable.
- D. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For dry-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

#### 1.7 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. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
  - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

**PART 2 - PRODUCTS**

2.1 SYSTEM DESCRIPTIONS

- A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.

2.2 Double-Interlock Pre-action Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Detection devices are located within the protected zone and monitored by a fire suppression releasing panel. Water is admitted to the system after the operation of both detection devices and automatic sprinklers located within the protected zone. PERFORMANCE REQUIREMENTS

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
1. NFPA 13.
  2. FM Global
  3. Manufacturer recommendations
- B. High-Pressure Piping System Component: Listed for 250-psig maximum working pressure.
- C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design dry-pipe sprinkler systems.
1. Contractor to conduct water flow and pressure test, and base the hydraulic calculations on the results.
- D. Sprinkler system design shall be approved by Cornell EHS/FP Engineer, FM Global and authorities having jurisdiction.
1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.

2. Sprinkler Occupancy Hazard Classifications:
    - a. Refer to Contract Drawings
  3. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. Refer to Contract Drawings, NFPA 13 and FM Global Requirements
  4. Maximum Protection Area per Sprinkler: According to UL listing.
  5. Maximum Protection Area per Sprinkler:
    - a. Comply with NFPA 13 and FM Global
  6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
- E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI ].

### 2.3 STEEL PIPE AND FITTINGS

- A. Schedule 40, Black-Steel Pipe: ASTM A 53/A 53M, Type F. Pipe ends may be factory or field formed to match joining method.
- B. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- C. Uncoated, Steel Couplings: ASTM A 865, threaded.
- D. Malleable- or Ductile-Iron Unions: UL 860.
- E. Cast-Iron Flanges: ASME B16.1, Class 150.
- F. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Shurjoint Piping Products.
- G. Grooved-Joint, Steel-Pipe Appurtenances:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. National Fittings, Inc.
    - c. Shurjoint Piping Products.
    - d. Tyco Fire & Building Products LP.
    - e. Victaulic Company.
  2. Pressure Rating: 250-psig minimum.

3. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

#### 2.4 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating:
  1. High-Pressure Piping Specialty Valves: 250-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Dry-Pipe Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Globe Fire Sprinkler Corporation.
    - b. Reliable Automatic Sprinkler Co., Inc.
    - c. Tyco Fire & Building Products LP.
    - d. Venus Fire Protection Ltd.
    - e. Victaulic Company.
    - f. Viking Corporation.
  2. Standard: UL 260.
  3. Design: Differential-pressure type.
  4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
- G. Air-Pressure Maintenance Device:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Globe Fire Sprinkler Corporation.
    - b. Reliable Automatic Sprinkler Co., Inc.
    - c. Tyco Fire & Building Products LP.
    - d. Venus Fire Protection Ltd.
    - e. Victaulic Company.
    - f. Viking Corporation.
  2. Standard: UL 260.
  3. Type: Automatic device to maintain minimum air pressure in piping.
  4. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure,



strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure

H. Air Compressor:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Gast Manufacturing Inc.
  - b. General Air Products, Inc,
  - c. Viking Corporation.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Motor Horsepower: Fractional.
4. Power: 120-V ac, 60 Hz, single phase.

I. Deluge Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. BERMAD Control Valves.
  - b. CLA-VAL Automatic Control Valves.
  - c. Globe Fire Sprinkler Corporation.
  - d. OCV Control Valves.
  - e. Reliable Automatic Sprinkler Co., Inc.
  - f. Tyco Fire & Building Products LP.
  - g. Venus Fire Protection Ltd.
  - h. Victaulic Company.
  - i. Viking Corporation.
2. Standard: UL 260.
3. Design: Hydraulically operated, differential-pressure type.
4. Include trim sets for alarm-test bypass, drain, electrical water-flow alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer.
5. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.

J. Air-Pressure Maintenance Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1) Globe Fire Sprinkler Corporation.
  - 2) Reliable Automatic Sprinkler Co., Inc.
  - 3) Tyco Fire & Building Products LP.
  - 4) Venus Fire Protection Ltd.
  - 5) Victaulic Company.
  - 6) Viking Corporation.
- b. Standard: UL 260.
- c. Type: Automatic device to maintain minimum air pressure in piping.
- d. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to

maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.

2. Air Compressor:
  3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Gast Manufacturing Inc.
    - b. General Air Products, Inc,
    - c. Viking Corporation.
  4. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
  5. Motor Horsepower: Fractional.
  6. Power: 120-V ac, 60 Hz, single phase.
  7. 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
- K. Automatic (Ball Drip) Drain Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Reliable Automatic Sprinkler Co., Inc.
    - b. Tyco Fire & Building Products LP.
  2. Standard: UL 1726.
  3. Pressure Rating: 175-psig minimum.
  4. Type: Automatic draining, ball check.
  5. Size: NPS 3/4.
  6. End Connections: Threaded.

## 2.5 NITROGEN GENERATION SYSTEM

- A. Manufacturers: The basis of design manufacturer is Engineered Corrosion Solution (ECS). Subject to compliance with project requirements, other equivalent manufacturers and products may be submitted for consideration.
- B. ECS Protector Nitrogen Generator (PGEN):
1. Furnish and install a nitrogen generator system to service all dry/pre-action zones as required by the system size and pressure requirement stipulated in the drawings and installed per manufacturer's instructions.
  2. The nitrogen generator shall have an air compressor that is sized appropriately for the application and capable of achieving system supervisory pressure within 30 minutes in accordance with requirements of NFPA 13.
  3. The nitrogen generator shall provide a minimum of 98% purity nitrogen to the fire sprinkler system.
  4. The nitrogen generator shall be equipped with a filtration system to remove residual water and all hydrocarbons from the air stream.

5. The nitrogen generator shall have a nitrogen control panel capable of monitoring compressor runtimes, nitrogen generator pressure, and operational mode locally and over the internet.
  6. The nitrogen generator shall have a leak detection system capable of determining sprinkler system leak rates and give alerts if leaks develop within the sprinkler piping, nitrogen generator system or air compressor.
  7. Alerts shall be capable of being e-mailed.
  8. The nitrogen generator systems shall have the ability to automatically switch between air bypass mode and nitrogen generating mode based on the demands of the sprinkler system.
  9. The nitrogen generator shall have an air storage tank and nitrogen storage tank air that confirm to ASME standard for pressure vessel.
  10. The nitrogen generator is FM approved.
- C. ECS Protector SMART Gas Analyzer (SGA-1):
1. The fire sprinkler contractor shall furnish and install a fixed Online Gas Analyzer [for each nitrogen generator/as shown on the drawings] and as directed by the design engineer. The gas analyzer shall be installed in the fire sprinkler valve room and be configured to sample gas from the inerting vent attached to the largest FPS being supplied by the nitrogen generator and per manufacturer's instructions.
  2. Each fixed gas analyzer shall be supplied by an inerting vent to supply the source gas for sampling.
  3. The contractor shall mount the fixed gas analyzer to a vertical wall within fifty (50) feet of the automatic inerting vent.
  4. The fixed gas analyzer shall be capable of the following output signals:
    - a. Gas purity (analog) configurable between 0-5V DC, 0-10VDC and 4-20mA
    - b. Gas alarm (DPST Form C Relay) with adjustable thresholds of 1%, 3% and 5% oxygen content
  5. The fixed gas analyzer shall be equipped with a digital display capable of being configured to display either oxygen or nitrogen gas purity levels.
  6. The contractor shall provide 24VDC or 120VAC power in conduit to the fixed gas analyzer. Coordinate power requirements and location with electrical contractor.
  7. All wiring and connections shall be per NFPA 70 and all local requirements.
  8. The contractor shall attach and affix 5/32 in. gas supply tubing from push fitting on the inerting vent to corresponding push fitting on the fixed gas analyzer. Gas supply tubing provided by manufacturer's commissioning engineer.
  9. The oxygen sensing element of the fixed gas analyzer shall have a minimum useful life of ten (10) years.

10. The contractor shall connect the fixed gas analyzer output to the [building monitoring system (BMS)/Fire Alarm Control Panel (FACP)]. Coordinate BMS/FACP interface with the controls and instrumentation contractor/electrical contractor/fire alarm contractor.

D. ECS Protector Handheld Gas Analyzer (PGHA-1):

1. The fire sprinkler contractor shall furnish a handheld gas analyzer with each nitrogen generator or as directed by the design engineer.
2. The handheld gas analyzer shall be equipped with a quick connect fitting compatible with gas sampling ports on all nitrogen generation system equipment and inerting vents.
3. The handheld gas analyzer shall include a one button calibration feature.
4. The oxygen sensing element of the handheld gas analyzer shall have a minimum useful life of two (2) years.

E. Air Maintenance Device

1. The fire sprinkler contractor shall furnish and install an approved air maintenance device for each dry or pre-action fire sprinkler system.
2. The air maintenance device shall be equipped with a field adjustable pressure regulator for use in setting the maximum system pressure.

Approved air maintenance devices are:

- a. Victaulic Series 757
  - b. Tyco Model AMD-1
  - c. Reliable Model A-2
  - d. Or approved equal
3. Air maintenance device shall be installed per the manufacturer's instructions.
  4. The Pressure Maintenance device shall be installed no greater than 7-ft above the finished floor and shall be readily accessible

F. COORDINATION WITH OTHER TRADES

1. Coordinate closely with the General Contractor, other trades and the Owner to expedite construction, commissioning and avoid interference

G. Supervision and Training

1. The fire sprinkler contractor shall provide on-site ECS Commissioning Services Package which shall include an ECS certified representative on-site for a minimum of one (1) day to verify the installation of the equipment and provide training to the Owner and Owner's Representative.

2.6 The fire sprinkler contractor shall provide one (1) printed copy and an electronic file of the Owner's Operation and Maintenance Manual for all corrosion control equipment. The Owner's Manual shall include protocols for operation and maintenance of all equipment installed as part of this scope of work.

2.6A. ~~SPRINKLER REQUIREMENTS FOR DRY PIPE SYSTEMS~~ Sprinkler Fittings: UL listed and FM Global approved for dry-pipe service.

B. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anvil International, Inc.
  - b. National Fittings, Inc.
  - c. Shurjoint Piping Products.
  - d. Tyco Fire & Building Products LP.
  - e. Victaulic Company.
2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

C. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AGF Manufacturing Inc.
  - b. Reliable Automatic Sprinkler Co., Inc.
  - c. Tyco Fire & Building Products LP.
  - d. Victaulic Company.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 250-psig.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Elkhart Brass Mfg. Company, Inc.
  - b. Fire-End & Croker Corporation.

- c. Potter Roemer.
  2. Standard: UL 199.
  3. Pressure Rating: 250-psig.
  4. Body Material: Brass.
  5. Size: Same as connected piping.
  6. Inlet: Threaded.
  7. Drain Outlet: Threaded and capped.
  8. Branch Outlet: Threaded, for sprinkler.
- E. Sprinkler Inspector's Test Fittings:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AGF Manufacturing Inc.
    - b. Tyco Fire & Building Products LP.
    - c. Victaulic Company.
    - d. Viking Corporation.
  2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
  3. Pressure Rating: 250-psig.
  4. Body Material: Cast- or ductile-iron housing with sight glass.
  5. Size: Same as connected piping.
  6. Inlet and Outlet: Threaded.
- F. Adjustable Drop Nipples:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aegis Technologies, Inc.
    - b. CECA, LLC.
    - c. CPS Products, Inc.
    - d. Merit Manufacturing; a division of Anvil International, Inc.
  2. Standard: UL 1474.
  3. Pressure Rating: 250-psig.
  4. Body Material: Steel pipe with EPDM O-ring seals.
  5. Size: Same as connected piping.
  6. Length: Adjustable.
  7. Inlet and Outlet: Threaded.
- G. Flexible Sprinkler Hose Fittings:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ALEUM, USA
    - b. Flexible Industries, Inc.
    - c. Victaulic Company
  2. Standard: UL 1474.
  3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.

4. Pressure Rating: 250-psig.
5. Size: Same as connected piping, for sprinkler.

## 2.7 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Reliable Automatic Sprinkler Co., Inc.
  2. Tyco Fire & Building Products LP.
  3. Victaulic Company.
  4. Viking Corporation.
- B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- C. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig.
- D. Automatic Sprinklers with Heat-Responsive Element:
  1. Nonresidential Applications: **[UL 199]**.
  2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K as indicated in contract documents, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- E. Sprinkler Finishes:
  1. Chrome plated
  2. Bronze
  3. Painted.
- F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
  2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- G. Sprinkler Guards:
- H. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Reliable Automatic Sprinkler Co., Inc.
  2. Tyco Fire & Building Products LP.
  3. Victaulic Company.
  4. Viking Corporation.
  5. Standard: UL 199.
  6. Type: Wire cage with fastening device for attaching to sprinkler.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

#### 3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
  - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install automatic (ball drip) drain valves to drain piping between fire department connections and check valves. Drain to floor drain or to outside building.
- J. Connect compressed-air supply to dry-pipe sprinkler piping.
- K. Connect nitrogen generator to the following piping and wiring:
  - 1. Pressure gages and controls.
  - 2. Electrical power system.
  - 3. Fire-alarm devices, including low-pressure alarm.



- L. Install alarm devices in piping systems.
- M. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.
- O. Drain dry-pipe sprinkler piping.
- P. Pressurize and check dry-pipe sprinkler system piping, pre-action sprinkler system piping, air-pressure maintenance devices and air compressors.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

### 3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- I. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- J. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
- K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.4 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
1. Install valves in vertical position for proper direction of flow, in main supply to system.
  2. Install dry-pipe valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
    - a. Install air compressor and compressed-air-supply piping.
    - b. Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 250-psig maximum inlet pressure.
    - c. Install compressed-air-supply piping from building's compressed-air piping system.

### 3.5 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

- B. Install sprinklers with water supply from heated space. Do not install pendent or sidewall sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

### 3.6 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13. Comply with requirements for identification specified in Section 210533 – “Identification for Fire-Suppression Piping and Equipment.”
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Energize circuits to electrical equipment and devices.
  - 5. Start and run air compressors.
  - 6. Coordinate with fire-alarm tests. Operate as required.
  - 7. Coordinate with fire-pump tests. Operate as required.
  - 8. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.8 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

### 3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.10 PIPING SCHEDULE

- A. Drain piping: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded joints.
- B. Dry-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
  - 1. Schedule 40, black-steel, type F pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
- C. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 and larger, shall be one of the following:
  - 1. Schedule 40, black-steel, type F pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.

3.11 SPRINKLER SCHEDULE

- A. Refer to the sprinkler schedule on the Contract Drawings for additional information.
- B. Use sprinkler types in subparagraphs below for the following applications:
  - 1. Rooms without Ceilings: Upright sprinklers.
  - 2. Rooms with Suspended Ceilings: concealed sprinklers as indicated on the contract drawings.
  - 3. Wall Mounting: Dry sidewall sprinklers.
  - 4. Spaces Subject to Freezing: Upright, dry pendent sprinklers; and dry sidewall sprinklers as indicated on the contract drawings.
  - 5. Special Applications: Extended-coverage and quick-response sprinklers where indicated and approved.
- C. Provide sprinkler types in subparagraphs below with finishes indicated.
  - 1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
  - 2. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
  - 3. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

End of Section

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Section 22 05 00

COMMON WORK RESULTS FOR PLUMBING

**PART 1 - GENERAL**

1.1 SUMMARY

- A. Provide a complete working installation with all equipment in proper operational condition. Documents may not show or list every item required. The documents do not undertake to show or list every item to be provided. When an item not shown or listed is necessary for the proper operation of equipment which is shown or listed, provide an item which will allow the system to function properly at no increase in Contract Sum.
- B. Should there be any direct conflict in the specifications and drawings the most stringent requirement shall govern.
- C. Provide all control devices for mechanical equipment and systems in conjunction with control system requirements, including coordination with Division 26 for electrical connection for complete, tested and operational systems.
- D. The requirements of this section apply to all the Work of Division 22.
- E. The scope of work shall include but not be limited to the following:
  - 1. Provide and install all piping for domestic water, natural gas, sanitary, storm, fuel oil system valves, specialties and accessories.
  - 2. Provide and install water heater, and accessories.
  - 3. Provide testing, adjusting and balancing for all systems.
  - 4. Carry out the commissioning requirements specified in Section 23 08 00 and other sections referenced in Division 1.
  - 5. Provide, design, dimension, coordinate, and install the following items specified as design build under specified performance criteria:
    - a. Support and anchorage of all equipment, valving, and piping. Refer to Section 22 05 29.
    - b. Vibration isolation and seismic anchorage. Refer to Section 22 05 48.
- F. Related Sections
  - 1. All sections within Division 23 - Heating, Ventilating, and Air Conditioning
  - 2. All sections within Division 21 – Fire Protection System
  - 3. All sections within Division 22 – Plumbing Systems
  - 4. All relevant sections within Division 26 – Electrical
  - 5. All sections within Division 1 - General Requirements
  - 6. Relevant sections within Division 3 - Concrete
    - a. Section 3 30 00 - Cast-In-Place Concrete
  - 7. Relevant sections within Division 5 - Metals
    - a. Section 55000 – Metal Fabrications
    - b. Section 55213 – Pipe and Tube Railings
  - 8. Relevant sections within Division 7 - Thermal and Moisture Protection
    - a. Section 07 84 00 - Fire Stopping

9. Relevant sections within Division 08 - Openings
    - a. Section 8 71 00 - Door Hardware
    - b. Section 89000 – Louvers and Vents
  10. Provisions of general LEED requirements and forms: 018113  
“Sustainable Design Requirements”.
- G. Comments on Construction Documents Drawings
1. The drawings show the general arrangement of all piping, and equipment. Examine drawings and specifications very carefully and notify the Architect and/or Owner's Representative by letter or Request for Information (RFI) of any discrepancies so these can be rectified at an early date.
  2. Should conditions necessitate any rearrangements, the Contractor shall prepare and submit drawings showing the changes before proceeding with the work. If such changes are approved, they shall become a part of this contract after their approval.
  3. Due to the small scale of the drawings, it is not possible to show all offsets and every detail of construction. Additional fittings, valves, traps, transitions, ducts, etc., shall be furnished and installed at no extra cost to the Owner.
  4. The drawings are diagrammatic and are a graphic representation of the Contract Requirements, produced according to the best available standards to an optimum scale. Dimensions of work as indicated on plans are not guaranteed to be as-built dimensions. No measurements shall be scaled from the Drawings for use as a definite dimension for layout or fitting work in place. The Contractor is solely responsible for dimensional control and coordination of the work to be installed.
  5. The layout of equipment, as shown on the plans, shall be checked and exact location determined by dimensions of equipment accepted for installation. Consult the Architectural and Structural Drawings for all dimensions, locations of partitions, sizes of structural members, foundations, etc.
  6. The Contractor shall be responsible for the coordination of the plumbing systems with mechanical ducting and piping distribution, with the fire sprinklers, lighting, conduit, cable tray, structural members, ceiling support and all other trades present within the project.
- H. Minor Deviation from Construction Documents
1. The dimensions and ratings of equipment herein specified or indicated on the Drawings are intended to establish the desired performance characteristics of such equipment. Minor deviations may be permitted after review by the Engineer and/or Owner's Representative to allow manufacturers specified to bid on their nearest standard equipment that provides at least the performance required.
  2. Manufacturers' catalog or model numbers and types mentioned in the Specifications or indicated on the drawings are used as design guides. In all cases, the manufacturer shall verify the duty specified with the particular characteristics of the equipment he intends to submit and shall submit only items which comply with Specification requirements.
  3. Where the equipment furnished differs in physical character from that specified or indicated, or where Contractor's substituted equipment requires increased service and facilities to be provided by other trades,

- and such substitution is acceptable to the Engineer, Architect and/or Owner's Representative, the Contractor shall bear all costs of providing services, facilities and modifications to the system or building.
4. Where the equipment furnished requires redesign of systems, connections, or configuration, and such substitution is acceptable to the Engineer, Architect, and/or Owner's Representative, the contractor shall bear all costs associated with design engineering and shall pay the time and materials cost of the Engineer, Architect and/or owner's representative's review of this documentation. In addition, it is the contractor's responsibility to obtain approval from the authority having jurisdiction.

## 1.2 REFERENCES

- A. References to standard codes, specification of regulatory agencies shall mean editions in effect at date of proposal. Reference to technical societies, trade organizations, governmental agencies is made in this Division in accordance with the following abbreviations:
  1. AGA American Gas Standard
  2. ANSI American National Standards Institute
  3. ASHRAE American Society of Heating, Refrigerating, and Air Conditioning Engineers
  4. ASME American Society of Mechanical Engineers
  5. ASSE American Society of Sanitary Engineering
  6. ASTM American Society for Testing and Materials
  7. AWWA American Water Works Association
  8. AWS American Welding Society
  9. CDA Copper Development Association
  10. CISPI Cast Iron Soil Pipe Institute
  11. EPA Environmental Protection Agency
  12. IAPMO International Association of Plumbing and Mechanical Officials
  13. NEC National Electrical Code
  14. NEMA National Electrical Manufacturers' Association
  15. OSHA Occupational Safety and Health Administration
  16. PDI Plumbing and Drainage Institute
  17. UL Underwriters Laboratories, Inc.
  18. FM FM Global

## 1.3 QUALITY ASSURANCE

- A. Nothing in these plans or specifications is to be construed to permit work not conforming to the prevailing codes and regulations. Should there be any direct conflict between any referenced standard and the governing code, the mandatory code language shall govern to set only the minimum requirements and the most stringent requirement shall govern. A letter or Request for Information (RFI) shall be generated to highlight the discrepancy.
- B. Install Work by craftsmen skilled in the trade involved and by apprentices as indicated in the General Conditions.



- C. Electrical Testing: Provide the services of a qualified testing laboratory/agency to perform the specified field tests. Notify the Owner's Representative 24 hours in advance of performance of Work requiring testing. Provide all materials required for testing. Refer to Division 26 for detailed requirements of electrical testing.
  
- D. Factory and Field Testing
  - 1. See each Section for the required testing and procedures.
  - 2. Test reports shall include:
    - a. Description of equipment tested.
    - b. Description of test procedures.
    - c. Test results.
    - d. Names and signatures of witnesses of tests.
  
- E. Performance testing
  - 1. Upon completion of the Work and following adjustment of all equipment, conduct an operating test for each system's acceptance. Demonstrate all systems and equipment to be operational and free from all electrical and mechanical defects.
  - 2. Notify the Owner's Representative fourteen days in advance of when tests will be performed. At that time, provide a test procedure plan, test schedule and test procedure forms.
  - 3. Coordinate the work of Performance Testing with the Commissioning Requirements for Pre-Functional and Functional Testing.
  
- F. Materials and Workmanship
  - 1. Materials shall be new, meet detailed requirements of the contract document and be identifiable as being specified or substitute products. Materials shall be kept in original packing material and protected from the elements by plastic and placed on dunnage until the item is installed. Once installed, all electrical devices shall be covered with sealed plastic until the building is fully enclosed and all spraying applications are complete.
  - 2. Materials that do not conform to the requirements of the contract documents, are not equal to approved samples or are unsatisfactory or unsuited to the purpose for which they are intended, will be rejected and shall not be installed.
  - 3. All work shall be performed by properly licensed plumbers, mechanics, and technicians with work limited to their respective trades.
  - 4. All equipment shall be installed in accordance with the recommendation of the manufacturer.
  - 5. Defective work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or other cause shall be removed within ten (10) days after written notice is given by the Owner's Representative, and the work shall be re-executed by the Contractor. The fact that the Owner's Representative may have previously overlooked such defective work shall not constitute total or partial acceptance of it.
  - 6. In no case shall a Bidder base his bid on a class of material or workmanship less than that required by the contract documents nor the governing codes and ordinances.
  - 7. Materials and adhesives used throughout the plumbing systems for insulation, flexible connections and jackets or coverings regardless of kind for piping system components, shall have a flame spread rating not

over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating not higher than 50.

- G. Checking and Testing Equipment By Contractors and Manufacturer's Representative
1. All equipment shall be installed per the manufacturer's instructions. During construction request supervisory assistance from equipment manufacturer's representatives so the equipment will be correctly installed. After installation, request the Owner's Representative to inspect and see the equipment is in proper working order.
  2. Manufacturer's representative shall review the overall system design relative to the proper application of his equipment in the particular system. That person shall note conduit, wiring, control, location, and other relevant relationships, and furnish appurtenances necessary for satisfactory operation.
  3. Before equipment start up, the manufacturer's representative shall submit to the Owner's Representative, a signed statement certifying to their inspection and noting that the equipment is properly installed and ready for operation.

#### 1.4 SUBMITTALS

- A. Section 1 33 00 - Submittal Procedures
- B. Preliminary List of Materials and Equipment
1. Submit a Preliminary List of Materials and Equipment to the Owner's Representative for approval of manufacturers of all materials and equipment proposed to be provided for this project.
  2. The review of the Preliminary List of Material and Equipment shall only be construed to be a general review that the manufacturer is a recognized and reputable supplier of that general type of product and therefore eligible to submit his product in detail for review. The review designation of "no exception taken" to the Preliminary List does not exempt the Contractor from proving that the particular and specific equipment meets the project's requirements.
  3. Submit the List of Materials and Equipment for review/approval in accordance with Section 1 33 00: Submittal Procedures. Submit at least one month prior to the first submittal.
- C. Submittal Schedule
1. Provide a submittal schedule at least one month prior to the first submittal.
  2. The submittal schedule shall be a complete list of all submittals to be made with projected date of submittal.
  3. The submittal schedule shall assume at least one "Revise and Resubmit" cycle. Delay to schedule associated with submittals' "Revise and Resubmit" designation are ineligible for change orders, as timely and correct work is a requirement of this contract.
- D. General Organization of Submittals

1. Submit as a minimum all the required data listed in the documents as specifying performance, material, and dimensions. Refer to individual specification sections, schedules, and drawings for requirements.
  2. Organize submittals in the same sequence as they appear in specification sections, articles or paragraphs.
  3. Each submission shall be made under the Specification Section Number it has been specified under. Submittals including equipment specified under a different specification section will be rejected and returned without review. Each section is required to be tracked separately for status designation, even if multiple sections are physically collated into a single binder.
  4. Identify each item with each submittal by reference to Specification Section paragraph in which the item is specified or Drawing and Detail number. Annotate the submittal sheets with the equipment identification numbers appearing on the equipment schedule.
  5. Include all information requested by the Specification Section in a single submittal. With the exception of shop drawings, incomplete submittals or phased submittals under the same specification section are not acceptable and will be returned without review.
  6. Submit pertinent catalog and performance data sheets only. Annotate pages to clearly identify which specific product is submitted and for what tag number or application. Contractors shall not submit entire catalogs.
  7. Submission shall be made in the form of a tab-indexed brochure. Index sheets shall be required for all material, plumbing fixtures and equipment, including but not limited to pipe, fittings, valves, insulation, etc. as listed. Index sheets shall be set up with columns to identify the following:
    - a. Specification clause number or drawing/detail number
    - b. Item type
    - c. Tag number as appropriate and/or application
    - d. Requirement from drawing schedule and specification
    - e. Feature data provided to show compliance
    - f. Compliance: yes or no
    - g. Notes from Contractor
  8. Provide the number of submittal and shop drawing copies as defined under Section 1 33 00.
- E. Plumbing Fixtures and Equipment Submittals:
1. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment. Words "as specified" are not sufficient identification.
  2. Mark each item and data on each sheet. Where multiple product model types are listed on a single sheet, the contractor shall clearly indicate which specific item is submitted. If different model numbers of a single product line are submitted for different uses, this should be clearly annotated, identifying each individual use cross-referenced by the requirement it intends to fulfill. Submittals without annotation will be rejected and returned without review.
  3. Submittal literature, drawings and wiring diagrams shall be specifically applicable to this project and shall not contain extraneous material or optional choices. Clearly mark literature to indicate the proposed item

and its relevant features or options. Submittals shall include all those items listed in each individual Section.

- F. Shop Drawings:
1. Prepare reproducible CAD drawings in AutoCAD.
  2. Shop drawings shall be provided for all systems included in Division 23 and for all areas addressed in the Construction Documents.
  3. Piping installation drawings shall be fully dimensioned complete with elevations and all fittings, valves, devices. Include details and dimensioned locations of supports, anchors and expansion devices. Dimensions shall be from gridlines. All equipment shall be shown to scale and shall match the required dimensions from the equipment submittals. All equipment access clearances shall be marked explicitly on the Shop Drawings with manufacturer and code required distances dimensioned and annotated as such.
  4. The drawings shall be minimum 1/4" = 1'-0" scale.
  5. Independent structural support and structural pad drawings shall be submitted for review by Structural Engineer.
  6. All equipment shall be labeled to match the schedules.
  7. The Contractor shall assure that each trade has coordinated work with other trades, prior to submittal. Division 22 shop drawings shall be issued after the coordination drawings are signed off by all other trades. Any conflicts that occur with other trades shall be brought to the attention of the Owner's Representative prior to issuance of the shop drawings.
  8. Shop fabrication, coordination and installation drawings that are prepared to scale by the Contractor are for his use and shall be his responsibility. These Drawings indicate where he intends to install the fixtures, material and equipment as required by the Contract Documents. Submission of contract documents or electronic files of contract documents for shop drawings is not sufficient as this would be an indication that field-level construction coordination has not taken place. Any such submittal will be rejected and returned without review.
  9. Prepare and submit supplementary Shop Drawings for all Work in "tight" areas, clearly indicating solutions to space problems and coordination with Work in other Sections. Identify congested conditions and provide a sufficient number of sections to demonstrate the solution proposed. These Drawings, as a requirement of this Division, shall indicate, superimposed, Work of all Sections involved in congested area, including plumbing piping, ductwork, piping, electrical work, ceiling work, equipment access requirements, etc. Include all mechanical rooms at larger scale and with sections under this clause. Identification of space problems without solutions is not acceptable within a shop drawing.
  10. During the shop drawing review process the owner's representative may request that supplementary shop drawings be produced for clarification and explicit demonstration of coordination in congested areas. This work shall be performed by the contractor at no cost as necessary under the previous clause.
  11. Prepare and submit Shop Drawings for all Work deviating from that indicated on Contract Drawings. Clearly indicate deviations and cross reference through notes the reason why the deviation was made.
  12. Shop Drawings shall show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance,

- access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, weight.
- a. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of the Contract Documents.
  - b. Drawings shall be to scale and dimensioned (except piping diagrams not to scale).
  - c. Drawings shall clearly show all required openings in construction, points of connection of other trades, and support locations and loads.
  - d. Drawings may be prepared by vendor but shall be submitted as instruments of the Contractor. Such drawings shall be thoroughly checked and developed by the contractor to include the full contract scope. They shall be stamped by Contractor before submission for review.
  - e. Catalog cuts and published material may be included to supplement scale drawings.
13. Each drawing shall have a blank space for use by the Owner's Representative and Contractor in recording disposition of material per Section 1 33 00.
- G. Coordinated Drawings:
1. Refer to Section 1 33 00 Submittal Procedures for requirements.
  2. Coordinated drawings shall be provided for all areas.
  3. Coordinated Drawings shall show work of all trades including, but *not limited to*:
    - a. Piping, including:
      - 1) HVAC, Plumbing and Fire Protection.
      - 2) Minor Piping such as Drains, Air Vents, Condensate Piping, etc.
      - 3) Sleeves and Penetrations.
      - 4) Expansion Devices, Anchors, Guides and Hangers, Seismic Anchorage Devices.
    - b. Equipment, including points of connection and manufacturer's recommended access space. Nothing shall enter or cross through the required access space, which is defined as the volume extending from the top of the device to be maintained down to the floor. Any ceiling which interrupts this space shall be entirely removable including T-bars, vertical supports and seismic bracing of ceiling which shall be arranged to avoid the access zone.
    - c. Supports and Suspension Devices.
    - d. Piping High Points and Low Points.
    - e. Electrical Equipment.
    - f. Main Electrical Conduits and Bus Ducts.
    - g. Equipment Support and Suspension Devices including Hangers, Supports and Bracing.
    - h. Structural and Architectural Constraints including Beams, Braces, Trusses, Flanges, Constraints, Walls, Openings Ratings, Doors, Wall Types and Glazing.
    - i. Show location of:
      - 1) Valves.
      - 2) Piping Specialties.

- 3) Access Doors and Equipment Removal Paths.
  - 4) Control and Electrical Panels.
  - 5) Disconnect, Hand/OFF/Auto, and Emergency Power Off Switches.
  - 6) All control sensors, control panels and required installation distances for access and stable performance.
4. Drawings shall indicate coordination with work in other Divisions which must be incorporated in mechanical spaces, including, but not limited to:
    - a. Mechanical equipment, piping and duct.
    - b. Irrigation Equipment and Piping.
    - c. Elevator Equipment.
    - d. Electrical Equipment.
    - e. Cable Trays.
  5. Provide sections and elevations for all mechanical rooms, mechanical areas, areas with routed piping mains, and areas adjacent to the existing structure.
- H. Substitutions:
1. In accordance with Section 1 60 00, and where permitted in each section.
  2. Specified products or equipment mean those named on the equipment schedules or identified as Specified Manufacturers herein. All other manufacturers listed are considered substitutions and must meet the requirements of this Section. Only manufacturers identified as Possible Substitutions in this specification may be offered as substitutions for approval.
  3. Substitution requests shall come simultaneous to the relevant submittal and shall not come through the RFI process, unless directed by the Owner's Representative.
  4. Submit shop drawings and proposed products that differ from the specified products and also indicate products with connections and show arrangements. Show necessary modifications of architectural, structural, plumbing, electrical and mechanical Work required by the proposed products, including relocation of drains, revised electrical circuits, relocation of roof or wall penetrations, and revised foundations.
  5. Accompany request for substitution review with table of comparison listing pertinent features of both specified and proposed materials including all scheduled data, material of construction, performance criteria, overall length, width, height dimensions, space required for tube replacement or maintenance access, motor type, horsepower, voltage, phase service factor, noise levels and controls. This is to be submitted in addition to the index sheet required above for all submittals. Review of proposed substitution will not be made without simultaneous receipt of satisfactory comparison tabulation. The substitution request shall also identify the offered reduction in contract value, which shall be inclusive of all cost associated with work by other trades. If paper copies of data from the referenced manufacturer are provided along with the submitted manufacturer as backup data for the table of comparisons, these shall be explicitly separated via tabs clearly marked as follows:
    - a. Substitution request and comparison table
    - b. Submitted data from requested manufacturer
    - c. Reference data from specified manufacturer

6. Limit submittal of substitutions to one proposal for each type or kind of item, unless otherwise explicitly permitted by the Owner. If the proposed product substitution is rejected by the Owner's Representative, submit the specified product at no cost to the project.
  7. Review of drawings and other material submitted as a substitution shall not be construed as a complete check or constitute a waiver of the requirements of the Contract Documents. This review shall not relieve the Contractor of the responsibility to fit the proposed materials to the spaces provided, and to effect necessary rearrangement or construction of other Work.
  8. Any additional work required by other trades as a result of a substitution shall be covered under this Contract, without any additional cost or time delay imposed on the project.
  9. When a substitution is proposed, the Contractor shall be responsible to ensure that the performance and quality of the scheduled or specified equipment is met. If additional accessories are required to achieve performance, they shall be provided at no cost.
- I. Resubmittals:
1. Resubmittals shall be reviewed for compliance with the comments made on the original submittal. Clearly identify replies to comments, through a cover letter by the Contractor that lists each comment and the resolution of that comment. Mark with submittal number and date.
  2. Non-compliant items which were not noticed in an earlier submittal but are noticed in a resubmittal shall be noted as non-compliant and the resubmittal tagged for corrective action. The fact that the owner's representative may have overlooked the defect shall not constitute total or partial acceptance of it. The contractor remains responsible for delivering an installation that meets the design intent. All corrective action shall be performed at no additional cost or delay to the project.
  3. Re-submittals shall be complete and shall be explicitly annotated to note all changes. Contractor shall not just include specific responses to review comments, but shall show how the resubmittal data has been corrected and how all consequences of the change have been accommodated.
  4. Changes made in the resubmittal which are not directly a response to an earlier review comment shall be clearly identified on the letter of transmittal provided with the re-submittal and annotated within the body of the submittal. The reason for the change shall be included.
  5. One resubmittal will be reviewed. Review time for all second and higher resubmittals will be charged on a time and materials basis to the contractor regardless of the cause of the resubmittal. This will include all submittals to change manufacturer or equipment type after an original submittal was returned with no exceptions taken, unless the change is directly related to a Bulletin.
- J. Submittals – Checking
1. Before submitting shop drawings or equipment submittals to the Owner's Representative, the contractor shall check them in detail to be sure that all requirements of the plans and specifications have been fully met.
  2. Incomplete submittals and submittals not in accordance with the above requirements shall be returned without action, and resubmittal shall be required.

3. Review of drawings and other material submitted shall not be construed as a complete check or constitute a waiver of the requirements of the Contract Documents. This review shall not relieve the Contractor of the responsibility to fit the proposed materials to the spaces provided, to coordinate with the other trades and to effect necessary rearrangement or construction of other Work.
4. Review is not intended to verify dimensions or quantities, or to coordinate items shown on these Drawings. Review is for general conformance with design concept of the Project and general compliance with the information given in the Contract Documents. Contractor is responsible for dimensions, which shall be confirmed and correlated at the Jobsite, for fabrication processes and techniques or construction, for coordination of his Work with that of all other trades, for installed performance and the satisfactory quality of his work.
5. Review by the Owner's Representative of Submittals does not release the Contractor from full compliance with the requirements of the plans and specifications when Submittals deviate from these requirements.
6. Even though Submittals have been stamped "Reviewed" and no exceptions have been taken by the Engineer, the Contractor shall be fully responsible for all unauthorized deviations from the Drawings and specifications. Authorization for deviation will be made only by means of a letter from the Owner's Representative. The Owner's Representative's reviewed "No Exceptions Taken" stamp on a Submittal is not an authorization for a deviation from the plans and specifications.
7. Any corrections or modifications made by the Owner's Representative shall be deemed acceptable to the Contractor with no change in contract amount unless written notice is received by the Owner's Representative prior to the performance of any work affected by any corrections or modifications.
8. No material or equipment shall be released for manufacturer or shipment without first obtaining the Owner's Representative approved shop drawings.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. In accordance with Section 17700 - Closeout Procedures: Record Documents, and as follows.
- B. Keep up-to-date during the progress of the job through, one set of drawings indicating the Record installation. In addition to changes made during course of Work, show following by dimension from readily obtained base line reference points:
  1. Exact location, type, and function of concealed valves and controllers.
  2. Exact size, invert elevations and location of above floor, underground and under floor piping.
- C. Underground utility services, both inside and outside of buildings, shall be dimensioned from permanent structures or bend mark. Utility services outside of buildings shall also show depth of burial with reference to the finished ground floor elevation.



- D. This set of drawings shall be kept on the project site at all times and shall be available for inspection by Owner's Representative or Construction Manager weekly.
- E. Submit completed Drawings to Owner's Representative for approval prior to authorization for final payment. Record drawings shall be certified as to their correctness by the signature of the Contractor and shall be stamped or otherwise identified as record drawings.
- F. At the completion of the project the Contractor shall submit record as-built drawings as specified under Section 17700 and their electronic CAD files. Drawings shall incorporate all the Owner's and Architect's comments and represent completed as-built conditions.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Instructions and Manuals: In accordance with requirements of Section 17700 and as follows:
  - 1. Subsequent to completion of balancing and testing operations, this Division is responsible for instructing the owner's authorized representatives in all aspects of operation, adjustment and maintenance of mechanical plant and other mechanical equipment. Submit certificate, signed by owner's representative, attesting to their having been instructed per Section 17700 and as specified under individual Equipment section of this specification.
  - 2. Instructions on major items such as pumps, water heaters, etc. shall be by representative of manufacturer of the respective equipment.
  - 3. One month prior to request for final inspection, submit Operating and Maintenance manuals under Section 17700.
  - 4. Manuals shall include the following:
    - a. Section 1: A comprehensive table of contents and guide to the manuals contents and layout. This section shall enable the reader to comprehend the scope and purpose of the document and to identify readily where specific information can be obtained.
    - b. Section 2: Contractual and Legal records including:
      - 1) Name and Address of the installation.
      - 2) Details of City and State approvals.
      - 3) Name and Contact details of the Design Team and Installing Contractors and associated sub-contractors.
      - 4) Dates for Start of Installation, Substantial Completion, and Expiry of Warrantee period.
      - 5) Copies of maintenance service contracts and contact details for local service company.
      - 6) Copies of warrantees and bonds.
    - c. Subsequent Sections:
      - 1) Startup and Shutdown Procedures:
        - a) Provide a step-by-step write-up of all major equipment. When manufacturer's printed start-up, troubleshooting and shut-down procedures are available, they shall be incorporated into the operating manual for reference.

- 2) Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
  - 3) Service Instructions: Provide the following information for all pieces of equipment:
    - a) Recommended spare parts, including catalog number and the name, manufacturer's name and contact information, address and telephone number of local suppliers of factory representative.
  - 4) Lubrication and maintenance instructions and recommended service maintenance schedule for all equipment including all electric motors. Sample maintenance record forms for each equipment type.
  - 5) A lubrication chart listing each item of equipment, all points of lubrication, proper lubricant, dates lubricated, and lubrication schedule.
  - 6) Data sheets to show complete internal wiring, mechanical and electrical ratings and characteristics, catalog data on component parts whether furnished by equipment manufacturer or others, names, addresses and telephone numbers of source of supply for parts subject to wear or electrical failure, and description of operating, test, adjustment, and maintenance procedures.
    - a) Where data sheets included in manual cover equipment, options, or other features not part of equipment actually furnished, line out these references or otherwise clearly mark so remaining text, diagrams, drawings, schedules, and similar information shall apply specifically to equipment furnished.
    - b) Final submittals for equipment shall have final corrections included in the prints used for the manual.
  - 7) Equipment List: List of all major equipment as installed shall include model number, capacities, and nameplate data. Include in the manuals, parts catalogs for each item of equipment furnished by him with the components identified by number of for replacement ordering.
  - 8) Valve charts organized on a room and sequence basis, detailing room, system and valve numbers.
5. Controls Binder: Bind data in vinyl covered loose-leaf binders with title index tabs identifying items therein to include:
- a. Detailed list of all control set points and control and wiring diagrams and software.
  - b. Detailed description of sequence of operation of each system, with charts and diagrams. Include emergency operation performance and resetting procedures as appropriate. Include explicit definition of all setpoints, alarm triggers, loop tuning coefficients, and ranges present within programming at time of handover.

- c. Provide full size copies of Record one-line diagrams, folded into plastic covers. Obtain Record prints from Owner's Representative at Contractor's cost and have prints thin laminated by a firm normally engaged in this work.
- d. Provide laminated control diagrams. Diagrams shall show complete equipment, controls, model numbers, etc., marked to correspond to identification on equipment.
- 6. Certification Binder
  - a. Certificates: Submit final inspection certificates signed by governing authorities.
  - b. Letters from manufacturers certifying their supervision of equipment installation and start-up procedures.
  - c. Machinery vibration test reports.
  - d. Certificates of sterilization/chlorination of plumbing systems.
  - e. Test certificates.
  - f. Instruction certificates.
  - g. Final inspection certificate signed by governing authorities.
- 7. Submit drafts of service and maintenance instruction sheets to Owner's Representative for review before preparing final sets.

#### 1.7 TEMPORARY FACILITIES

- A. Temporary Water: Provided under Section 15000.
- B. Temporary Light and Power: Provided under Section 15000.

#### 1.8 REGULATIONS, CODES, PERMITS AND FEES

- A. Conform to all rules, regulations, laws, and ordinances governing the area in which this construction occurs.
- B. Obtain the required permits from the local authorities for this work and pay for all fees required by the State and Federal authorities for permits, inspections and review, including special agency construction and operating permits. Make corrections in the work as required by the Owner's Representative or Inspector to pass local regulations.
- C. Provide local authorities with all notices relating to this Division.
- D. Provide Owner, Owner's Representative and local Inspectors access to work at all times.
- E. Contractor shall be responsible for all law violations caused by the work under this Division. Notify the Owner's Representative in writing when a discrepancy occurs between code requirements and work shown on drawings and resolve matter before proceeding with work.
- F. Make application and pay for all certificates of inspection, taxes and permits required by Local, State or Federal Governments, public utilities, or other authorities having lawful jurisdiction. Deliver to the Owner's Representative any and all certificates of inspections, permits, and approvals that may be required by such authorities.

1.9 COOPERATION BETWEEN TRADES

- A. Division 1 – General Requirements
- B. Cooperate with all other Divisions performing work on this project as necessary to achieve a complete neatly fitted installation for each condition. Consult the Drawings and Specifications to determine nature and extent of work specified in other Divisions that adjoins, shares space with, or attaches to the work of this Division. Confer with other Divisions at the site to coordinate this work with theirs in view of job conditions to the end that interferences may be eliminated, and that maximum headroom and clearance may be obtained. If interferences develop, the Owner's Representative's decision will be final as to which Division shall relocate its work, and no additional compensation will be allowed for the moving of piping, ductwork, conduit or equipment to clear such interferences.
- C. Electrical Work for Plumbing Equipment
  - 1. Division 26 Contractor: Wire all mechanical equipment furnished by this Division in accordance with the following general provisions:
    - a. Provide 120-volt emergency power circuits available at panel for control contractor's use.
    - b. Provide and wire heavy-duty, quick-make, quick-break type disconnect switches, manual pushbuttons and other fire alarm hard-wiring specifically called for in the documents or noted in electrical specifications and wherever required by Code.
    - c. Receive, unload, set, and rough align all separately shipped motors.
    - d. Receive, unload, set and install all motor starters and variable frequency drives.
    - e. Wire all miscellaneous solenoid valves, relays and other components provided with equipment which is not factory wired or part of control contractor's scope.
    - f. Wire fire alarm lighting controls and other monitoring systems for interface with Building Management and Control System.
    - g. Wire interlocks between equipment as called for in Controls specifications.
    - h. Provide final equipment connections for all equipment with voltage greater than 120-volt, including overcurrent protection and disconnect.
    - i. Provide final equipment connections for 120-volt equipment that requires motor starters. Include starter, overcurrent protection, and disconnect.
  - 2. Division 22 shall provide the following:
    - a. All control devices noted on the drawings and within the specifications.
    - b. Complete and accurate wiring diagrams to Division 26 for all equipment requiring electrical power wiring.
    - c. Separately shipped motors and variable frequency drives shall be installed by Division 26. Adjustable motor bases and all bolts and nuts required for installation of base and motor shall be provided and installed by Division 22.
    - d. Field lubricate all motors prior to operation and maintain lubrication prior to acceptance of equipment by the Owner's Representative.

- e. Provide motor terminal connection diagram as prepared by motor manufacturers.
  - f. Provide 120V wiring from dedicated J-box to Control Panels or controllers.
  - g. Provide control wiring from Control Panel to controlled device.
- D. Cutting and Patching
- 1. The Contractor shall do all cutting of building materials, piping, etc., as required for the installation of work.
  - 2. No structural members shall be cut without the prior approval of the Owner's Representative. To gain approval to cut concrete, Ferrosan the affected area and submit scan results to Structural Engineer for review. Submit to Owner's Representative, drawings and details for the support of structure around the opening. If the standard structural details are to be used, then submit a plan that cross-references all penetrations against detail numbers for review. Otherwise, submit drawings, design, and calculations stamped by a Registered Professional Structural Engineer in the State of New York. Any cutting and remedial support shall be done in a manner satisfactory to the Owner's Representative.
  - 3. Patching of building structure, walls, floors, etc. during normal work progress with Requirements of Division 1.
  - 4. All patching of or repair of damage to completed work in place shall be done to meet with the approval of the Owner's Representative.
  - 5. All cutting shall be performed with machine saw. Holes for pipes in concrete walls or floors shall be drilled with core drilling equipment.
  - 6. Work in place that is subsequently cut is seen as evidence of the contractor's lack of field coordination during the shop drawing production phase. Because field coordination is a requirement of the contract, the contractor must bear all costs of cutting, patching and repair for corrective work

## **PART 2 - PRODUCTS**

- 2.1 NOT USED

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF EQUIPMENT**

- A. Install equipment according to the manufacturer's instructions, code requirements, and required access clearances.

### **3.2 LOCAL AND EXISTING CONDITIONS**

- A. Prior to bidding visit the site and determine all existing conditions affecting work in this Division. Examine all Drawings and Specifications to familiarize with the type of construction to be used, and the nature and extent of work of other trades.

- B. Observe the conditions under which deliveries of materials and equipment shall be made and under which such materials and equipment can be stored and shall include adequate provision in the bid proposal.
- C. Any connections to or relocation of any existing utility line requiring temporary discontinuance of utility services which are in active use shall be scheduled and coordinated with the utility companies and the Owner's Representative. In no case shall the services be left disconnected at the end of a working day or weekend unless authorized by representatives of the utilities and the Owner. Any existing utility service damaged shall be repaired to the satisfaction of the Owner's Representative.

### 3.3 PROVISIONS FOR LATER INSTALLATIONS

- A. At the start of the project, meet with the Owner's Representative to obtain information regarding allowable sleeve or penetration spacing and size.
- B. Where any Plumbing work cannot be installed as the work progresses, the Contractor shall provide and arrange for the building in of boxes, sleeves, inserts, fixtures or devices as necessary to permit installation of the omitted work during later phases of construction. This field coordination work shall be completed prior to structural shop drawings and shall follow the principles set forth in the meeting reference above. Arrange for and lay out any chases, holes, or other openings that must be provided in masonry, concrete or other work.
- C. The Contractor shall be responsible for being aware of the nature and arrangement of the materials and construction to which the work attaches or passes through, and shall propose support and penetration details that are consistent with maintaining the integrity and performance of the construction such as, but not limited to, fire-resistive construction, acoustically rated construction, vibrated isolated construction, water tight construction, fire proofed construction, and isolated construction.
- D. This work shall be incorporated into the initial shop drawing review of the construction (wall, floor, etc.) that is affected so that the owner's representative may review the impact of the holes.
- E. The contractor shall bear the cost of time and materials for the Owner's Representative to re-analyze the construction if the original spacing principles are not adhered to, for whatever reason.
- F. Once the structural shop drawings are returned with no exception taken, the contractor shall bear the cost of time and materials for the owner's representative to review the appropriateness of cutting or drilled holes in planned or existing construction.

### 3.4 HOIST, RIGGING, TRANSPORTATION AND SCAFFOLDING

- A. Provide all scaffolding, staging, cribbing, tackle hoist and rigging necessary for placing all materials and equipment in their proper places in the project. All temporary work shall be removed from the premises when its use is no longer required.

- B. Prior to placing equipment or scaffolding, the contractor shall provide written verification that the structure on which the load is imposed has sufficient strength to accommodate the point and/or line loads.

### 3.5 PROTECTION AND STORAGE

- A. All stock-piled material shall be placed on pallets and protected from weather and from entry of foreign material and construction dust by plastic. All stored materials and equipment shall be carefully inspected and cleaned prior to installation and replaced with new material or equipment if found to be damaged, corroded, etc.
- B. Equipment which is observed to be exposed to the weather, dirt or construction debris can be interpreted by the owner's representative as defective equipment under this clause.

### 3.6 FIELD VERIFICATION

- A. All dimensions, locations of equipment and connections to utilities or pre-existing equipment shall be verified in field prior to construction and installation.
- B. Architectural plans will hold precedence over mechanical plans as to location of partitions and diffusers.
- C. Measurements in existing buildings shall take precedence over all other plans with regards to identifying location of existing installations.
- D. All roughing in construction dimensions shall be made from architectural plans where discrepancies may exist. No change orders will be allowed for shifts in mechanical piping, ductwork, or equipment to match rough-in hole locations within 10 feet or original mechanical drawings.
- E. Plumbing plans shall take precedence over electrical and mechanical plans with regards to placement of plumbing equipment and layout of electrical and mechanical equipment within rooms designated as "plumbing rooms."

### 3.7 TOOLS AND EQUIPMENT

- A. Furnish all tools and equipment necessary for the proper installation, protection and upkeep of the work.

### 3.8 EXCAVATION, TRENCHING AND BACKFILL

- A. Coordinate trenching and backfill required for the installation of this Division as detailed in Division 31. Repair or replace all street, roadway, sidewalk, pavements and other work incidental thereto.
- B. Perform all excavations, trenching, and backfill required to complete the work in this Division, regardless of the character of the materials encountered or the method of excavation required.

- C. All excavations shall be inspected by the Owner's Representative and approved before placing of any pipe or duct.
- D. Pumping equipment shall be provided as necessary to keep trenches free from standing water. All shoring necessary to maintain the banks of excavations and to prevent any sloughing or caving-in, and as necessary to prevent damage of any kind which may occur in connection with this work shall be furnished and installed by the Contractor.

### 3.9 CLEANING

- A. Clean premises of all excess construction material and debris caused by work, in accordance with Section 17700.
- B. Surfaces shall be left clean, debris shall be removed, and equipment shall be furnished in prime coat finish unless otherwise specified.
- C. Clean exterior of piping and equipment, exposed in complete structure. Remove rust, paint overspray, fireproofing overspray, plaster and dirt by wire brushing; remove grease, oil and similar materials by wiping with clean rags and suitable solvents.
- D. Motors, Pumps and Other Items with Factory Finish: Remove grease, oil, paint overspray, fireproofing overspray, gypsum board mud splatters and leave surfaces clean.

### 3.10 FINAL INSPECTION

- A. As the work nears completion, review the requirements of the Contract Documents, inspect the work and inform all parties involved in work to be corrected or completed before the project can be deemed substantially complete.
- B. When the project is substantially complete, notify the Owner's Representative in writing of this fact, listing those items of work remaining incomplete, the reason for incompleteness, and the anticipated date that all remaining work will be completed. Carry out own final inspection and be satisfied that the work is complete. Final inspection of the project will then be scheduled by the Owner's Representative.
- C. The Owner's Representative reserves the right to cancel and reschedule the inspection in the event considerable more work remains to be completed or corrected than indicated in the written request for inspection.
- D. All items not completed or found not complying with drawings or specifications by the Owner's Representative will be identified in an inspection report by Owner's Representative.
- E. Correct all items on inspection report. Make the correction and initial and date each item on the report after corrections have been completed.



3.11 PROJECT CLOSE-OUT

- A. Prior to requesting Owner's Representative's inspection for certification of substantial completion, complete the following and list known exceptions in request:
1. Obtain final inspections and approvals from all governmental jurisdictions that are required for the project.
  2. Submit record drawings, maintenance manuals, warranties, and similar final record information.
  3. Deliver tools, spare parts, extra stocks of materials, and similar physical items to the Owner.
  4. Complete start-up, testing and demonstration of systems to the satisfaction of the Owner's Representative that the entire installation is complete, properly adjusted and is in proper operating condition.
  5. Complete final cleaning requirements.

End of Section

Section 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

**PART 2 - PRODUCTS**

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate

connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

## 2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Re-greasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: **[Class F]**.
- J. Code Letter Designation:
  - 1. Motors **[15]** HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors smaller than **[15]** HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes **[324T]** and larger; rolled steel for motor frame sizes smaller than **[324T]**.

## 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F

- insulation.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

## 2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
- 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

## **PART 3 - EXECUTION (Not Applicable)**

End of Section

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Section 22 05 16

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Flexible-hose packless expansion joints.
  - 2. Metal-bellows packless expansion joints.
  - 3. Rubber packless expansion joints.
  - 4. Grooved-joint expansion joints.
  - 5. Pipe loops and swing connections.
  - 6. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
- B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
  - 2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
  - 3. Alignment Guide Details: Detail field assembly and attachment to building structure.

4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of expansion joint, from manufacturer.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For expansion joints to include in maintenance manuals.

#### 1.7 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  2. ASME Boiler and Pressure Vessel Code: Section IX.

### PART 2 - PRODUCTS

#### 2.1 PACKLESS EXPANSION JOINTS

- A. Flexible-Hose Packless Expansion Joints:
  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:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Flexicraft Industries.
    - b. Mason Industries, Inc.
    - c. Metraflex Company (The).
  3. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
  4. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
  5. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
    - a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
    - b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.

- 
6. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.
    - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.
  7. Expansion Joints for Steel Piping NPS 2 and Smaller: Stainless-steel fittings with threaded end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
    - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F and 515 psig at 600 deg F ratings.
  8. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Stainless-steel fittings with flanged end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.
    - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F and 200 psig at 600 deg F ratings.
  9. Expansion Joints for Steel Piping NPS 8 to NPS 12: Stainless-steel fittings with flanged end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F and 90 psig at 600 deg F ratings.
    - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.
- B. Metal-Bellows Packless Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
    - a. Flex Pression Ltd.
    - b. Flexicraft Industries.
    - c. Hyspan Precision Products, Inc.
    - d. Mason Industries, Inc.
    - e. Metraflex Company (The).
    - f. U.S. Bellows, Inc.
  3. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
  4. Type: Circular, corrugated bellows with external tie rods.
  5. Minimum Pressure Rating: **175 psi** unless otherwise indicated.
  6. Configuration: Single joint with base and double joint with base class(es) unless



- otherwise indicated.
7. Expansion Joints for Copper Tubing: **Single- or multi-**ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
    - a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint or threaded.
    - b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Solder joint or threaded.
    - c. End Connections for Copper Tubing NPS 5 and Larger: Flanged.
- C. Rubber Packless Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Flex-Weld, Inc.
    - b. Flexicraft Industries.
    - c. Mason Industries, Inc.
    - d. Metraflex Company (The).
    - e. Red Valve Company, Inc.
  3. Standards: ASTM F 1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
  4. Material: Fabric-reinforced rubber complying with FSA-NMEJ-703.
  5. Arch Type: Single or multiple arches with external control rods.
  6. Spherical Type: Single or multiple spheres with external control rods.
  7. Minimum Pressure Rating for NPS 1-1/2 to NPS 4: 150 psig at 220 deg F.
  8. Minimum Pressure Rating for NPS 5 and NPS 6: 140 psig at 200 deg F.
  9. Minimum Pressure Rating for NPS 8 to NPS 12: 140 psig at 180 deg F.
  10. Material for Fluids Containing Acids, Alkalies, or Chemicals: EPDM.
  11. Material for Fluids Containing Gas, Hydrocarbons, or Oil: Buna-N.
  12. Material for Water: EPDM .
  13. End Connections: Full-faced, integral steel flanges with steel retaining rings.

## 2.2 GROOVED-JOINT EXPANSION JOINTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  1. Anvil International, Inc.
  2. Shurjoint Piping Products.
  3. Victaulic Company.
- C. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

- D. Standard: AWWA C606, for grooved joints.
- E. Nipples: Galvanized, ASTM A 53/A 53M, Schedule 40, Type F or S, steel pipe with grooved ends.
- F. Couplings: flexible type for steel-pipe dimensions. Include ferrous housing sections, EPDM gasket suitable for cold and hot water, and bolts and nuts.

## 2.3 ALIGNMENT GUIDES AND ANCHORS

### A. Alignment Guides:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Advanced Thermal Systems, Inc.
  - b. Flexicraft Industries.
  - c. Hyspan Precision Products, Inc.
  - d. Mason Industries, Inc.
  - e. Metraflex Company (The).
  - f. U.S. Bellows, Inc.
- 3. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

### B. Anchor Materials:

- 1. Steel Shapes and Plates: ASTM A 36/A 36M.
- 2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
- 3. Washers: ASTM F 844, steel, plain, flat washers.
- 4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
  - a. Stud: Threaded, zinc-coated carbon steel.
  - b. Expansion Plug: Zinc-coated steel.
  - c. Washer and Nut: Zinc-coated steel.
- 5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
  - a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
  - b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on

- stud unless otherwise indicated.
- c. Washer and Nut: Zinc-coated steel.

### **PART 3 - EXECUTION**

#### **3.1 EXPANSION-JOINT INSTALLATION**

- A. Install expansion joints of sizes matching sizes of piping in which they are installed.
- B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
- C. Install rubber packless expansion joints according to FSA-NMEJ-702.
- D. Install grooved-joint expansion joints to grooved-end steel piping

#### **3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION**

- A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.
- C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.
- D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

#### **3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION**

- A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
- B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
- C. Attach guides to pipe and secure guides to building structure.
- D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- E. Anchor Attachments:
  - 1. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding

- and Brazing Qualifications."
  - 2. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
  - 3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.
- F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
- 1. Anchor Attachment to Steel Structural Members: Attach by welding.
  - 2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
- G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

End of Section

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Section 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Stack-sleeve fittings.
  - 3. Sleeve-seal systems.
  - 4. Sleeve-seal fittings.
  - 5. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

- G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

## 2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Smith, Jay R. Mfg. Co.
  - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with setscrews.

## 2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. Metraflex Company (The).
  - 4. Pipeline Seal and Insulator, Inc.
  - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## 2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Presealed Systems.
- B. Description: Manufactured plastic, sleeve-type, water-stop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber water-stop collar with center opening to match piping OD.

2.5 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

**PART 3 - EXECUTION**

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

- 1. Sleeves are not required for core-drilled holes.
- B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- C. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire-stop materials. Comply with requirements for fire-stopping specified in Section 078413 "Penetration Fire-stopping."



### 3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
  - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
  - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
  - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with fire-stop materials. Comply with requirements for fire-stopping specified in Section 078413 "Penetration Fire-stopping."

### 3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water-stop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

### 3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves
    - b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves

2. Exterior Concrete Walls below Grade:
  - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve-seal system
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
  - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve-seal system
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
  - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves, Molded-PE or -PP sleeves.
  - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves

End of Section

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Section 22 05 18

ESCUTCHEONS FOR PLUMBING PIPING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
    - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
    - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
  - 2. Escutcheons for Existing Piping:
    - a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
    - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
    - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
    - g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
    - h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
    - i. Bare Piping in Equipment Rooms: Split-casting brass type with polished,

- chrome-plated finish.
    - j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.
  - C. Install floor plates for piping penetrations of equipment-room floors.
  - D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
    - 1. New Piping: One-piece, floor-plate type.
    - 2. Existing Piping: Split-casting, floor-plate type.
- 3.2 FIELD QUALITY CONTROL
  - A. Replace broken and damaged escutcheons and floor plates using new materials.

End of Section

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Section 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Thermometers.
  - 2. Thermowells.
  - 3. Pressure gages.
  - 4. Gage attachments.
  - 5. Test plugs.
- B. Related Sections:
  - 1. Section 221116 "Domestic Water Piping" for water meters inside the building.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

**PART 2 - PRODUCTS**

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of



the following:

- B. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
  - 1. Ashcroft Inc.
  - 2. Marsh Bellofram.
  - 3. Terice, H. O. Co.
- C. Standard: ASME B40.200.
- D. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.
- E. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C].
- F. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.
- G. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- H. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- I. Window: Plain glass or plastic.
- J. Ring: Stainless steel.
- K. Element: Bimetal coil.
- L. Pointer: Dark-colored metal.
- M. Accuracy: Plus or minus [1] percent of scale range.
- N. Remote-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. AMETEK, Inc.; U.S. Gauge.
    - b. Ashcroft Inc.
    - c. Terice, H. O. Co.
  - 3. Standard: ASME B40.200.
  - 4. Case: Sealed type, plastic; 6-inch nominal diameter with back flange and holes for panel mounting.
  - 5. Element: Bourdon tube or other type of pressure element.
  - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.

8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Metal or plastic
11. Connector Type(s): Union joint, threaded, bottom; with ASME B1.1 screw threads.
12. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
  - a. Design for Thermowell Installation: Bare stem.
13. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.2 LIQUID-IN-GLASS THERMOMETERS

### A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Terice, H. O. Co.
3. Standard: ASME B40.200.
4. Case: Cast aluminum; 6-inch nominal size.
5. Case Form: Back angle unless otherwise indicated.
6. Tube: Glass with magnifying lens and blue or red organic liquid.
7. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
8. Window: Glass or plastic.
9. Stem: Aluminum or brass and of length to suit installation.
  - a. Design for Thermowell Installation: Bare stem.
10. Connector: 3/4 inch, with ASME B1.1 screw threads.
11. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.3 THERMOWELLS

### A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.

6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## 2.4 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AMETEK, Inc.; U.S. Gauge.
  - b. Ashcroft Inc.
  - c. Marsh Bellofram.
  - d. Terice, H. O. Co.
  - e. Weiss Instruments, Inc.
  - f. WIKA Instrument Corporation - USA.
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. AMETEK, Inc.; U.S. Gauge.
  - b. Ashcroft Inc.
  - c. Marsh Bellofram.
  - d. Terice, H. O. Co.
  - e. Weiss Instruments, Inc.
  - f. WIKA Instrument Corporation - USA.
3. Standard: ASME B40.100.
4. Case: Liquid-filled type(s); cast aluminum or drawn steel; 6-inch nominal diameter.
5. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
6. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
7. Movement: Mechanical, with link to pressure element and connection to pointer.
8. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
9. Pointer: Dark-colored metal.
10. Window: Glass.
11. Ring: Stainless steel.
12. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
13. .

## 2.5 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

- B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

## 2.6 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Flow Design, Inc.
  - 2. National Meter, Inc.
  - 3. Trerice, H. O. Co.
  - 4. Weiss Instruments, Inc.
- C. Description: Test-station fitting made for insertion into piping tee fitting.
- D. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- E. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- F. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F
- G. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install test plugs in piping tees.
- K. Install thermometers in the following locations:
  - 1. Inlet and outlet of each water heater.
  - 2. Inlets and outlets of each domestic water heat exchanger.
  - 3. Inlet and outlet of each domestic hot-water storage tank.
  - 4. Inlet and outlet of each remote domestic water chiller.
- L. Install pressure gages in the following locations:
  - 1. Building water service entrance into building.
  - 2. Inlet and outlet of each pressure-reducing valve.
  - 3. Suction and discharge of each domestic water pump.

### 3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

### 3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

### 3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
  - 1. Liquid-filled, bimetallic-actuated type.
  - 2. Direct-mounted, metal-case, vapor-actuated type.
  - 3. Compact-style, liquid-in-glass type.
  - 4. Direct-mounted, light-activated type.
  - 5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be **one of** the following:
  - 1. Liquid-filled, bimetallic-actuated type.
  - 2. Direct-mounted, metal-case, vapor-actuated type.
  - 3. Compact-style, liquid-in-glass type.

4. Direct-mounted, light-activated type.
  5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:
1. Liquid-filled, bimetallic-actuated type.
  2. Direct-mounted, metal-case, vapor-actuated type.
  3. Compact-style, liquid-in-glass type.
  4. Direct-mounted, light-activated type.
  5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- 3.5 THERMOMETER SCALE-RANGE SCHEDULE
- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F and minus 20 to plus 50 deg C.
  - B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F and 0 to 150 deg C.
- 3.6 PRESSURE-GAGE SCHEDULE
- A. Pressure gages at discharge of each water service into building shall be one of the following:
    1. Liquid-filled, direct-mounted, metal case.
    2. Sealed, direct-mounted, plastic case.
    3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
  - B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:
    1. Liquid-filled, direct-mounted, metal case.
    2. Sealed, direct-mounted, plastic case.
    3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
  - C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:
    1. Liquid-filled, direct-mounted, metal case.
    2. Sealed, direct-mounted, plastic case.
    3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- 3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE
- A. Scale Range for Water Service Piping: 0 to 100 psi.
  - B. Scale Range for Domestic Water Piping: 0 to 100 psi.

End of Section

Section 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bronze angle valves.
2. Brass ball valves.
3. Bronze ball valves.
4. Iron ball valves.
5. Iron, single-flange butterfly valves.
6. Iron, grooved-end butterfly valves.
7. Bronze lift check valves.
8. Bronze swing check valves.
9. Iron swing check valves.
10. Iron swing check valves with closure control.
11. Iron, grooved-end swing check valves.
12. Iron, center-guided check valves.
13. Iron, plate-type check valves.
14. Bronze gate valves.
15. Iron gate valves.
16. Bronze globe valves.
17. Iron globe valves.
18. Lubricated plug valves.
19. Chainwheels.

B. Related Sections:

1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.



- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- B. Valve Sizes: Same as upstream piping unless otherwise indicated.
- C. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 1. Gate Valves: With rising stem.
  - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- D. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Grooved: With grooves according to AWWA C606.
  - 3. Solder Joint: With sockets according to ASME B16.18.
  - 4. Threaded: With threads according to ASME B1.20.1.
- E. Valve Bypass and Drain Connections: MSS SP-45.
- F. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Milwaukee Valve Company.
    - d. Conbraco Industries, Inc.; Apollo Valves.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig.
    - c. CWP Rating: 600 psig.
    - d. Body Design: Two piece.
    - e. Body Material: Forged brass.
    - f. Ends: Threaded.
    - g. Seats: PTFE or TFE.
    - h. Stem: Stainless steel.
    - i. Ball: Stainless steel, vented.
    - j. Port: Full.

## 2.2 BRONZE BALL VALVES

### A. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:
  - a. Conbraco Industries, Inc.; Apollo Valves.
  - b. Milwaukee Valve Company.
  - c. NIBCO INC.
  - d. Crane Co.; Crane Valve Group; Jenkins Valves.
  
2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig
  - c. CWP Rating: 600 psig
  - d. Body Design: Three piece.
  - e. Body Material: Bronze.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Stainless steel.
  - i. Ball: Stainless steel, vented.
  - j. Port: Full.

## 2.3 IRON BALL VALVES

### A. Class 125, Iron Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.; Apollo Valves.
  - b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  
2. Description:
  - a. Standard: MSS SP-72.
  - b. CWP Rating: 200 psig
  - c. Body Design: Split body.
  - d. Body Material: ASTM A 126, gray iron.
  - e. Ends: Flanged.
  - f. Seats: PTFE or TFE.
  - g. Stem: Stainless steel.
  - h. Ball: Stainless steel.
  - i. Port: Full.

2.4 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Division.
    - d. Milwaukee Valve Company.
    - e. Red-White Valve Corporation.
    - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  2. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 200 psig
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: Bronze.
- B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Division.
    - d. Milwaukee Valve Company.
  2. Description:
    - a. Standard: MSS SP-80, Type 4.
    - b. CWP Rating: 200 psig
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: PTFE or TFE.
- C. Class 150, Bronze Swing Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Division.
    - d. Milwaukee Valve Company.

2. Description:
  - a. Standard: MSS SP-80, Type 3.
  - b. CWP Rating: 300 psig
  - c. Body Design: Horizontal flow.
  - d. Body Material: ASTM B 62, bronze.
  - e. Ends: Threaded.
  - f. Disc: Bronze.

D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Milwaukee Valve Company.
2. Description:
  - a. Standard: MSS SP-80, Type 4.
  - b. CWP Rating: 300 psig
  - c. Body Design: Horizontal flow.
  - d. Body Material: ASTM B 62, bronze.
  - e. Ends: Threaded.
  - f. Disc: PTFE or TFE.

2.5 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Milwaukee Valve Company.
2. Description:
  - a. Standard: MSS SP-71, Type I.
  - b. CWP Rating: 200 psig
  - c. Body Design: Clear or full waterway.
  - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - e. Ends: Flanged.
  - f. Trim: Bronze.
  - g. Gasket: Asbestos free.

2.6 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

- A. Class 125, Iron Swing Check Valves with Lever- and Weight-Closure Control:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.Crane Co.; Crane Valve Group; Jenkins Valves.
    - b. Crane Co.; Crane Valve Group; Stockham Division.
    - c. Milwaukee Valve Company.
  2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. CWP Rating: 200 psig
    - c. Body Design: Clear or full waterway.
    - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - e. Ends: Flanged.
    - f. Trim: Bronze.
    - g. Gasket: Asbestos free.
    - h. Closure Control: Factory-installed, exterior lever and weight.

2.7 IRON, GROOVED-END SWING CHECK VALVES

- A. 300 CWP, Iron, Grooved-End Swing Check Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Tyco Fire Products LP; Grinnell Mechanical Products.
    - c. Victaulic Company.
  2. Description:
    - a. CWP Rating: 300 psig
    - b. Body Material: ASTM A 536, ductile iron.
    - c. Seal: EPDM.
    - d. Disc: Spring-operated, ductile iron or stainless steel.

2.8 IRON, CENTER-GUIDED CHECK VALVES

- A. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. APCO Willamette Valve and Primer Corporation.

- b. Flo Fab Inc.
- c. Milwaukee Valve Company.
- d. Or approved equal.

2. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 200 psig
- c. Body Material: ASTM A 126, gray iron.
- d. Style: Compact wafer.
- e. Seat: EPDM or NBR.

2.9 IRON, PLATE-TYPE CHECK VALVES

A. Class 125, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Flomatic Corporation.
- d. Mueller Steam Specialty; a division of SPX Corporation.
- e. Or approved equal.

2. Description:

- a. Standard: API 594.
- b. CWP Rating: 200 psig
- c. Body Design: Wafer, spring-loaded plates.
- d. Body Material: ASTM A 126, gray iron.
- e. Seat: Bronze.

2.10 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Milwaukee Valve Company.

2. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.

- d. Ends: Threaded or solder joint.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron.

## 2.11 IRON GATE VALVES

### A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Milwaukee Valve Company.
2. Description:
  - a. Standard: MSS SP-70, Type I.
  - b. CWP Rating: 200 psig
  - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - d. Ends: Flanged.
  - e. Trim: Bronze.
  - f. Disc: Solid wedge.
  - g. Packing and Gasket: Asbestos free.

### B. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Milwaukee Valve Company.
2. Description:
  - a. Standard: MSS SP-70, Type I.
  - b. CWP Rating: 200 psig
  - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - d. Ends: Flanged.
  - e. Trim: Bronze.
  - f. Disc: Solid wedge.
  - g. Packing and Gasket: Asbestos free.



2.12 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Milwaukee Valve Company.
2. Description:
  - a. Standard: MSS SP-85, Type I.
  - b. CWP Rating: 200 psig
  - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - d. Ends: Flanged.
  - e. Trim: Bronze.
  - f. Packing and Gasket: Asbestos free.

2.13 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Nordstrom Valves, Inc.
2. Description:
  - a. Standard: MSS SP-78, Type II.
  - b. CWP Rating: 200 psig
  - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
  - d. Pattern: Venturi.
  - e. Plug: Cast iron or bronze with sealant groove.

2.14 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.
4. Or approved equal.

- B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
  - 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
  - 2. Attachment: For connection to ball and plug valve stems.
  - 3. Chain: Brass, of size required to fit sprocket rim.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

#### **3.2 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for ball, gate, and plug valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.

#### **3.3 ADJUSTING**

- A. Adjust or replace valve packing after piping systems have been tested and put into

service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
1. Shutoff Service: Ball, valves.
  2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
  3. Throttling Service: Globe or angle valves.
  4. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
    - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilient-seat check valves.
    - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
  4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  6. For Steel Piping, NPS 5 and Larger: Flanged ends.
  7. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

### 3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
  2. Ball Valves: Two piece, full port, brass or bronze with stainless-steel trim.
  3. Bronze Swing Check Valves: Class 150], bronze disc.
  4. Bronze Gate Valves: Class 150, NRS.
  5. Bronze Globe Valves: Class 150, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead

- of flanged ends.
- 2. Iron Ball Valves: Class 150.
- 3. Iron Swing Check Valves: Class 125, metal seats.
- 4. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.
- 5. Iron, Grooved-End Swing Check Valves: 300 CWP.
- 6. Iron, Center-Guided Check Valves: Class 125 globe, resilient seat.
- 7. Iron, Plate-Type Check Valves: Class 125; dual plate; metal seat.
- 8. Iron Gate Valves: Class 125 OS&Y.
- 9. Iron Globe Valves: Class 125.

### 3.6 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

#### A. Pipe NPS 2 and Smaller:

- 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
- 2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
- 3. Bronze Swing Check Valves: Class 125, nonmetallic disc.
- 4. Bronze Gate Valves: Class 125, [RS].
- 5. Bronze Globe Valves: Class 125, bronze disc.

#### B. Pipe NPS 2-1/2 and Larger:

- 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
- 2. Steel Ball Valves: Class 150.
- 3. Iron Swing Check Valves: Class 125, metal seats.
- 4. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.
- 5. Iron, Grooved-End Swing Check Valves: 300 CWP.
- 6. Iron Gate Valves: Class 125 OS&Y.
- 7. Iron Globe Valves: Class 125.
- 8. Lubricated Plug Valves: Class 250, regular gland.

End of Section

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Section 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Thermal-hanger shield inserts.
6. Fastener systems.
7. Pipe stands.
8. Pipe positioning systems.
9. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment

shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  1. Trapeze pipe hangers.
  2. Metal framing systems.
  3. Fiberglass strut systems.
  4. Pipe stands.
  5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  1. Detail fabrication and assembly of trapeze hangers.
  2. Design Calculations: Calculate requirements for designing trapeze hangers.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

#### 1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

#### A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

#### B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

#### C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

### 2.2 TRAPEZE PIPE HANGERS

- #### A.
- Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

### 2.3 METAL FRAMING SYSTEMS

#### A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Cooper B-Line, Inc.
  - b. Flex-Strut Inc.
  - c. Thomas & Betts Corporation.
  - d. Unistrut Corporation; Tyco International, Ltd.
3. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
4. Standard: MFMA-4.



5. Channels: Continuous slotted steel channel with inturned lips.
6. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
8. Metallic Coating: Hot-dipped galvanized

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Anvil International; a subsidiary of Mueller Water Products Inc.
  - b. Empire Industries, Inc.
  - c. Haydon Corporation; H-Strut Division.
  - d. NIBCO INC.
3. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
4. Standard: Comply with MFMA-4.
5. Channels: Continuous slotted steel channel with inturned lips.
6. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
8. **Coating: [Zinc].**

## 2.4 FIBERGLASS STRUT SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  1. Allied Tube & Conduit.
  2. Champion Fiberglass, Inc.
  3. Cooper B-Line, Inc.
- C. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.
  1. Channels: Continuous slotted fiberglass channel with inturned lips.
  2. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
  3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

## 2.5 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carpenter & Paterson, Inc.
  - 2. National Pipe Hanger Corporation.
  - 3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
  - 4. Rilco Manufacturing Co., Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.7 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## 2.8 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

## 2.9 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.10 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi, 28-day compressive strength.

### PART 3 - EXECUTION

#### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- H. Pipe Stand Installation:
  - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- I. Pipe Positioning-System Installation: Install support devices to make rigid supply and

waste piping connections to each plumbing fixture.

- J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- M. Install lateral bracing with pipe hangers and supports to prevent swaying.
- N. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **NPS 2-1/2** and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- O. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- P. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- Q. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

- b. NPS 4: 12 inches long and 0.06 inch thick.
  - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
  - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
  - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
- 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
  - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to **1-1/2 inches**.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in [**Section 099113 "Exterior Painting."**] [**Section 099123 "Interior Painting."**] [**Section 099600 "High-Performance Coatings."**]
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension

- of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
  7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.



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2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

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- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

End of Section

Section 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Valve tags.
  - 5. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT LABELS

#### A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

#### B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, [**1/8 inch**] thick, and having predrilled holes for attachment hardware.
2. Letter Color: White
3. Background Color: Black
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

#### C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

#### D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

### 2.2 WARNING SIGNS AND LABELS

#### A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, **1/8 inch** thick, and having predrilled holes for attachment hardware.

- B. Letter Color: Black
- C. Background Color: Red
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch .
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

### 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

### 2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass beaded chain or S-hook
  - 3. Plastic tie-wraps are not acceptable as a means of securement.

- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surface of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."

- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of

- concealed piping.
- 5. Near major equipment items and other points of origination and termination.
- 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
- 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

- 1. Domestic Water Piping:
  - a. Background Color: Green
  - b. Letter Color: White.
- 2. Sanitary Waste and Storm Drainage Piping:
  - a. Background Color: Green
  - b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  - 1. Valve-Tag Size and Shape:
    - a. Cold Water: 2 inches, round
    - b. Hot Water: 2 inches, round
  - 2. Valve-Tag Color:
    - a. Cold Water: Natural
    - b. Hot Water: Natural.
  - 3. Letter Color:
    - a. Cold Water: Black
    - b. Hot Water: Black



3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

End of Section

Section 22 07 19

PLUMBING PIPING INSULATION

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
1. Domestic cold-water piping.
  2. Domestic hot-water piping.
  3. Domestic recirculating hot-water piping.
  4. Sanitary waste piping exposed to freezing conditions.
  5. Storm-water piping exposed to freezing conditions.
  6. Roof drains and rainwater leaders.
  7. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
1. Section 220716 "Plumbing Equipment Insulation."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets.
- B. LEED Submittals:
1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  2. Detail insulation application at pipe expansion joints for each type of insulation.
  3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  4. Detail removable insulation at piping specialties, equipment connections, and access panels.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

**PART 2 - PRODUCTS**

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Pittsburgh Corning Corporation; Foamglas.
  - 2. Block Insulation: ASTM C 552, Type I.
  - 3. Special-Shaped Insulation: ASTM C 552, Type III.
  - 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  - 5. Preformed Pipe Insulation with Factory-Applied **ASJ**: Comply with ASTM C 552, Type II, Class 2.
  - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
  - 7. Products: Subject to compliance with requirements, **provide one of the following**:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; SoftTouch Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. Owens Corning; SOFTR All-Service Duct Wrap.
- H. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000-Degree Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.
  2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Ramco Insulation, Inc.; Super-Stik.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Ramco Insulation, Inc.; Thermokote V.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; 739, Dow Silicone.
    - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding

- Adhesive.
  - c. P.I.C. Plastics, Inc.; Welding Adhesive.
  - d. Speedline Corporation; Polyco VP Adhesive.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
    - b. Eagle Bridges - Marathon Industries; 501.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
    - d. Mon-Eco Industries, Inc.; 55-10.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
  - 3. Service Temperature Range: 0 to 180 deg F.
  - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  - 5. Color: White.
- D. Breather Mastic: Water based; suitable for indoor use on above-ambient services.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B.

- b. Fuller Company; CP-10.
  - b. Eagle Bridges - Marathon Industries; 550.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
  - d. Mon-Eco Industries, Inc.; 55-50.
  - e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: 60 percent by volume and 66 percent by weight.
  5. Color: White.

## 2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
  1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
    - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    - c. Vimasco Corporation; 713 and 714.
  3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
  4. Service Temperature Range: 0 to plus 180 deg F.
  5. Color: White.

## 2.6 SEALANTS

- A. Joint Sealants:
  1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    - b. Eagle Bridges - Marathon Industries; 405.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Pittsburgh Corning Corporation; Pittseal 444.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Permanently flexible, elastomeric sealant.



4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.8 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic

adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. ABI, Ideal Tape Division; 491 AWF FSK.
  - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
  - c. Compac Corporation; 110 and 111.
  - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. ABI, Ideal Tape Division; 488 AWF.
  - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
  - c. Compac Corporation; 120.
  - d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

## 2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. ITW Insulation Systems; Gerrard Strapping and Seals.
  - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, **Type 304 or Type 316**; 0.015 inch thick, **3/4 inch** wide with **wing seal or closed seal**.

B. Wire: **0.062-inch** soft-annealed, stainless steel

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. C & F Wire.

## 2.11 PROTECTIVE SHIELDING GUARDS

### A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. McGuire Manufacturing.
  - b. Plumberex.
  - c. Truebro; a brand of IPS Corporation.
  - d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with

longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at **4 inches** o.c.

- a. For below-ambient services, apply vapor-barrier mastic over staples.
- 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor

- insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and

- irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. Label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
- 3.6 INSTALLATION OF CELLULAR-GLASS INSULATION
- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus



- twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.8 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
  - a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

### 3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by

removing jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
  - 1. NPS 1 and Smaller: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - 2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - 2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:
  - a. Cellular Glass: 1-1/2 inches thick.
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  
- D. Roof Drain and Overflow Drain Bodies:
  1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  
- E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
  1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  
- F. Sanitary Waste Piping Where Heat Tracing Is Installed:
  1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 2 inches thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.
  
- G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
  1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  
- H. Hot Service Drains:
  1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.
  
- I. Hot Service Vents:
  1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

End of Section

**SECTION 22 08 00**  
**PLUMBING SYSTEM COMMISSIONING**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: The Work of this Section shall include but not be limited to the following:
  - 1. Systems and equipment Start-Up and Functional Performance Testing.
  - 2. Validation of proper and thorough installation of Division 22 systems and equipment.
  - 3. Generic Start-Up Documentation for mechanical systems and equipment.
  - 4. Development of final Start-Up Documentation for mechanical systems and equipment.
  - 5. System Start-Up and Turn-Over procedures.
  - 6. Systems balancing verification.
  - 7. Coordination and execution of Training Events.

- B. Related Sections

- 1. The Cx process references many related Sections, particularly Section 01 91 00 - General Commissioning. It is important for all Contractors subject to the Cx process to be familiar with Section 01 91 00.
- 2. Refer to Section 01 91 00 for a complete list of Sections on Related Work.

1.3 GENERAL DESCRIPTION

- A. Commissioning (Cx) is the process of ensuring that (i) all building systems are installed and perform interactively according to the design intent; (ii) that systems are efficient and cost effective and meet the Owner's operational needs; (iii) that the installation is accurately documented; and (iv) that the Operators are adequately trained. Commissioning serves as a tool to minimize post-occupancy operational problems, and establishes testing and communication protocols to advance the building systems from installation to optimized, fully-dynamic operation.
- B. Commissioning Authority (CxA) shall work with the Contractor and the design engineers to direct and oversee the Cx process and perform Functional Performance Testing.
- C. The Commissioning Plan outlines the Cx process beyond the Construction Contract, including design phase activities and design team/owner responsibilities. The specification Sections dictate all requirements of the commissioning process relative to the construction contract. The Cx Plan is not part of the construction contract, although it is available for reference at the request of the Contractor.

- D. This Section outlines the Cx procedures specific to the Division 22 Contractors. Requirements common to all Sections are specified in Section 01 91 00 and Section 01 91 10 This Section and other sections of the specification details the Contractor's responsibilities relative to the Cx process.

#### 1.4 SCOPE

- A. The following are included in the Scope of Commissioning on this project:
  - B. Plumbing Systems
    - 1. Domestic hot water

#### 1.5 DEFINITIONS AND ABBREVIATIONS

- A. Refer to Section 01 91 00 for a complete list of Definitions and Abbreviations.

#### 1.6 REFERENCE STANDARDS

- A. Refer to Section 01 91 00 for a complete list of Reference Standards.

#### 1.7 DOCUMENTATION

- A. In addition to the documentation required in Section 01 91 00, Contractor shall provide to the CxA the following per the procedures specified herein, in the Cx Plan, and in other Sections of the specification:
  - 1. Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to Acceptance Phase. Factory Test Reports should be provided in PDF electronic format. These may include but are not limited to:
    - a. Pump Capacity
  - 2. Field Testing Agency Reports (other than TAB): Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports should be provided in PDF electronic format. These may include but are not limited to:
    - a. Pipe Pressure Testing
    - b. Potable Water Disinfection

#### 1.8 SEQUENCING AND SCHEDULING

- A. Refer Section 01 91 00.

#### 1.9 COORDINATION MANAGEMENT PROTOCOLS

- A. Coordination responsibilities and management protocols relative to Cx are initially defined in Section 01 91 00 and the Commissioning Plan, but shall be refined and documented in the Construction Phase Cx Kick-Off meeting. Contractor shall have input in the protocols and all Parties will commit to scheduling obligations. The CxA will record and distribute.

1.10 CONTRACTOR RESPONSIBILITIES

- A. Refer to Section 01 91 00: Detailed Contractor responsibilities common to all Divisions are specified in Section 01 91 00. The following are additional responsibilities or notable responsibilities specific to Division 22.
- B. Construction Phase
  - 1. Provide skilled technicians qualified to perform the work required.
  - 2. Provide factory-trained and authorized technicians where required by the Contract Documents.
  - 3. Prepare and submit required draft Start-Up Documentation and submit along with the manufacturer's application, installation and start-up information.
  - 4. Provide assistance to the CxA in preparation of the specific Functional Performance Test (FPT) procedures. Contractors, subcontractors and vendors shall review FPT procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests. Damage caused to equipment performed in accordance with the approved procedures will be the responsibility of the Contractor.
  - 5. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere in this Section.
  - 6. Start-Up, test/adjust/balance, and Turn-Over systems and equipment prior to functional performance testing by the CxA. Approved Start-Up Documentation shall be in accordance with Contract Documents, reference or industry standards, and specifically in Part I of this Section.
  - 7. Record Start-Up on approved Start-Up Documentation forms and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above and in Section 01 09 00. Each task or item shall be indicated with the Party actually performing the task or procedure.
- C. Acceptance Phase
  - 1. Assist CxA in functional performance testing. Assistance will generally include the following:
    - a. Manipulate systems and equipment to facilitate Functional Performance Testing (as specified in Section 01 91 00 and Section 01 91 10; in some cases this will entail only an initial sample);
    - b. Provide any specialized instrumentation necessary for Functional Performance Testing;
- D. Warranty Phase
  - 1. Maintain record documentation of any configurations, set ups, parameters etc, that change throughout the period.
  - 2. Provide representative for off season testing as required by CxA.
  - 3. Respond to Warranty issues as required by Division 1 and the General Conditions.

1.11 EQUIPMENT SUPPLIER RESPONSIBILITIES

- A. Refer to Section 01 91 00.

1.12 CONTRACTOR NOTIFICATION AND SCHEDULING

- A. Refer to Section 01 91 00.

1.13 START-UP DOCUMENTATION

- A. Refer to Section 01 91 00.

1.14 EQUIPMENT NAMEPLATE DATA

- A. Refer to Section 01 91 00.

1.15 FUNCTIONAL PERFORMANCE TESTING

- A. Contractor shall participate in the initial samples of Functional Performance Testing as stipulated in Section 01 91 00 and Section 01 91 10.

1.16 FPT ACCEPTANCE CRITERIA

- A. Acceptance criteria for tests are indicated in Section 01 91 10 and in the specification Sections applicable to the systems being tested. Generally, unless indicated otherwise, the criteria for acceptance will be that specified with the individual system, equipment, component, or device.

1.17 TRAINING

- A. Contractors, Subcontractor, Vendors, and other applicable Parties shall prepare and conduct training sessions on the installed systems and equipment they are responsible for per the requirements of Section 01 91 00 and the individual Specifications.

1.18 SYSTEMS MANUAL AND O&M DOCUMENTATION CONTENT - PREPARATION AND LOGISTICS

- A. Refer to Section 01 91 00 the individual Specifications.

**PART 2 - PRODUCTS**

2.1 INSTRUMENTATION

- A. General: All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
- B. Temperature sensors and digital thermometers shall have a certified calibration within the past year and a resolution of + or - 0.1°F.
- C. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

- D. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.
- E. Standard Testing Instrumentation: Standard instrumentation used for testing air and water flows, temperatures, humidity, noise levels, amperage, voltage, and pressure differential in air and water systems shall be provided by CxA.
- F. Special Tools: Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and turned over to the Owner upon project completion.

## 2.2 WEB-BASED COMMISSIONING PORTAL

- A. All general and major subcontractors participating in the Cx process shall use the web-based Cx Portal ('Portal') to document the Cx procedures. The Portal is a Web-based Internet hub used to electronically collaborate and coordinate activities and deliverables throughout the Cx process. The Portal is hosted by the CxA and shall be accessible to all Parties participating in the Cx program. The Portal provides a common location to store Start-Up Documentation, Functional Performance Tests and results, project documents and deliverables. It also serves as a collaborative email hub to facilitate, automate, and track communications between Parties relating to the Cx process.
- B. Refer to Section 01 91 00 the individual Specifications for additional information and requirements for using the Portal.

## PART 3 - EXECUTION

### 3.1 GENERIC START-UP DOCUMENTATION - GENERAL

- A. Part III of this Section outlines 'generic' or minimally acceptable Start-Up Documentation (which are defined to include both 'Start-Up Checks' and 'Start-Up Tests') and individual systems training requirements for systems and equipment. These procedures are the direct responsibility of the Contractor as a basic element of validating that the installation is correct per normal quality control practices. These items shall provide a minimally acceptable guideline for required Contractor development of Start-Up Documentation. Contractor shall synthesize these minimum requirements along with their own internal quality control practices, those of the manufacturer, and any applicable codes and standards to develop specific and itemized final Start-Up Documentation specific to the equipment and systems installed on this project.
- B. Section 01 91 00 defines the systems and equipment Start-Up process in detail and provides definitions for Start-Up Documentation, including the generic Start-Up Documentation provided below.

### 3.2 START-UP DOCUMENTATION COMMON TO ALL SYSTEMS

- A. The following Start-Up Documentation (Checklists and Tests) shall be considered common to all systems:



1. Checkout shall proceed from lower level devices to larger components to the entire system operation.
2. Verify labeling is affixed per specification and visible.
3. Verify prerequisite procedures are done.
4. Inspect for damage and ensure none is present.
5. Verify system is installed per the manufacturer's recommendations.
6. Verify system has undergone Start-Up per the manufacturer's recommendations.
7. Verify that access is provided for inspection, operation and repair.
8. Verify that access is provided for eventual replacement of the equipment.
9. Verify that record drawings, submittal data and O&M documentation accurately reflect the installed systems.
10. Verify all gauges and test ports are provided as required by contract documents and manufacturer's recommendations.
11. Verify all recorded nameplate data is accurate.
12. Verify that the installation ensures safe operation and maintenance.
13. Verify specified replacement material/stock has been provided as required by the Contract Documents.
14. Verify all rotating and moving parts are properly lubricated.
15. Verify all monitoring and ensure all alarms are active and set per Owner's requirements.
16. Complete all nameplate data and confirm that ratings conform to the design documents.

### 3.3 VALVES

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.
- B. Start-Up Checks: Perform the following checks during start-up and as specified in manufacturer's instructions:
  1. Operate all valves, manual and automatic, through their full stroke. Ensure smooth operation through full stroke and appropriate sealing or shutoff.
  2. Verify actuators are properly installed with adequate clearance.
  3. Verify all valves are labeled per the construction documents. Confirm that concealed valves are indicated on the finished building surface.
  4. For automatic pneumatically-operated valves, verify spring range and adjust pilot positioners where applicable.
  5. For electronically operated valves, check the stroke and range.

6. For all automated valves controlled by a program, ensure that the minimum and maximum stroke and ranges on the valves are coordinated with the limits entered in the program.

### 3.4 METERS AND GAUGES

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.
- B. Start-Up Checks: Perform the following checks during start-up and as specified in manufacturer's instructions:
  1. Adjust faces of meters and gauges to proper angle for best visibility.
  2. Clean windows of meters and gauges and factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint.
  3. For meters and gauges requiring temporary manual connection of read-out device such as pressure taps on a flow measuring device, ensure threads are clean and that connection can be made easily.
  4. Meters and gauges requiring manual connection of readout device shall be installed with adequate access to allow connection of device with normal tools.

### 3.5 MECHANICAL IDENTIFICATION

- A. Start-Up Checks: Perform the following checks:
  1. Verify all valve tags, piping, duct, and equipment labeling corresponds with drawings and indexes and meets requirements specified. Correct any deficiencies for all piping and duct systems.
  2. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
  3. Cleaning: Clean face of identification devices, and glass frames of valve charts.

### 3.6 MECHANICAL INSULATION

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.
- B. Start-Up Checks: Examine all piping, systems and equipment specified to be insulated.
  1. Ensure quality of insulation. Patch and repair all insulation damaged after installation.
  2. Ensure the integrity of vapor barrier around all cold surfaces.

### 3.7 PIPING - GENERAL

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.

- B. Start-Up Checks: These procedures apply to all installed piping systems, including underground site utilities.
1. Inspect all piping for proper installation, adequate support (with appropriate vibration isolation where applicable) and adequate isolation valves for required service.
  2. Submit welding certifications as required by the applicable specification section or referenced ASME specification.
  3. Submit certified welding inspection results per the applicable specification section or referenced ASME specification. ASME B31.1 requires 100% inspection based on pressure class.
  4. Provide notification of pipe cleaning and flushing activities.
  5. Flush and clean all piping and clean all strainers. Provide documentation of all related procedures.
  6. Ensure adequate drainage is provided at low points and venting is provided at high points.
  7. Ensure facilities to effectively drain and fill the system are in place.
  8. Ensure air is thoroughly removed from the system as applicable.
  9. Ensure all piping is adequately supported and anchored to allow expansion. Bump across-the-line pumps and inspect for excessive pipe movement.
  10. Provide notification of pressure testing.
  11. Pressure and/or leak test all applicable systems in accordance with the requirements in the applicable sections, ASME B 31.1 and 39.1 as applicable.
  12. Sterilize applicable piping systems as specified in the individual Sections and as required by regulatory authorities.
  13. Submit pressure test reports that document the pressure testing results with certification of the results.
  14. Verify the operation of applicable safety relief valves, operating controls, safety controls, etc. to ensure a safe installation.
  15. Set and adjust fill, pressure, or level controls to the required setting.

### 3.8 AC MOTORS

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.
- B. Start-Up Checks: Perform the following checks during start-up and as specified in manufacturer's instructions:
1. Verify proper alignment, installation, and rotation.
  2. Verify properly sized overloads are in place

- C. Start-Up Tests: Perform the following tests, measurements, or procedures during start-up and as specified in manufacturer's instructions:
  - 1. Measure insulation resistance, phase balance, and resistance to ground.
  - 2. Measure voltage available to all phases. Measure amps and RPM after motor has been placed in operation and is under load.
  - 3. Record all motor nameplate data.

### 3.9 BEARINGS

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.
- B. Start-Up Checks: Perform the following checks during start-up and as specified in manufacturer's instructions. This applies to all bearings on fans, pumps, compressors, and other equipment installed under this Division.
  - 1. Check alignment as applicable.
  - 2. Lubricate all bearings per the manufacturer's instructions. When bearing is used for temporary conditioning, lubricate on manufacturer's recommended frequency and document it.
- C. Start-Up Tests: Perform the following tests, measurements, or procedures during start-up and as specified in manufacturer's instructions:
  - 1. Use infrared thermometer to measure temperature at peak conditions. Ensure temperature is below manufacturer's recommendations.
  - 2. For bearings in drives with motors over 10 HP, use a vibration meter and measure the maximum peak-to-peak acceleration. Compare it to the Vibration Severity Chart. Rectify any condition causing severity indicated as "Rough" or worse.

### 3.10 PUMPS

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.
- B. Refer to 'AC Motors' in this Section.
- C. Refer to 'Bearings' in this Section.
- D. Refer to Division 22 Section "Testing, Adjusting, and Balancing" for detailed requirements for testing, adjusting, and balancing hydronic systems.
- E. Start-Up Checks: Perform the following checks during start-up:
  - 1. Check suction lines connections for tightness to avoid drawing air into the pump.
  - 2. Clean and lubricate all bearings.
  - 3. Check motor for proper rotation. Rotation shall match direction of rotation marked on pump casing.

4. Check that pump is free to rotate by hand. For pumps handling hot liquids, pump shall be free to rotate with the pump hot and cold. If the pump is bound or even drags slightly, do not operate the pump until the cause of the trouble is determined and corrected.
  5. Clean associated strainers.
  6. Check that the proper overloads have been installed in the starter and are the correct size.
  7. Verify that the integrity of the vibration isolation is maintained throughout the support and the connections.
  8. Align pump within manufacturers recommended tolerances.
  9. Ensure all associated piping has been cleaned, tested, and deaerated.
  10. Verify that all thermometers and gauges are installed, are clean and undamaged, and are functional.
- F. Start-Up Tests: Perform the following tests, measurements, or procedures during start-up:
1. Start the pump per the manufacturer's instructions.
  2. Check the general mechanical operation of the pump and motor.
  3. Verify that check valve seal is appropriate.
  4. Check noise and vibration levels and ensure they are within the manufacturer's recommended tolerances.
  5. Check that the NPSH is with that allowable for the operating condition.
  6. Refer to Division 22 Section "Testing, Adjusting, and Balancing" for detailed requirements for testing, adjusting, and balancing hydronic systems.

### 3.11 VARIABLE SPEED DRIVES

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.
- B. General: Provide the services of a factory authorized service representative to test and inspect unit installation, provide start-up service, and to demonstrate and train Owner's maintenance personnel as specified below.
- C. Start-Up Checks: Perform the following checks during start-up and as specified in manufacturer's instructions:
  1. Check unit for shipping damage.
  2. Perform a point-to-point continuity test for all field installed wiring interconnections. Verify terminations of field-installed wiring.
  3. Check for proper torque on connections.
  4. Verify use of shielded cable where specified and check that shields have been terminated properly.

5. Verify grounding.
  6. Check motor nameplate against drive input rating.
  7. Manually rotate motor shaft to ensure free rotation.
  8. Check that motor leads are not grounded.
- D. Start-Up Tests: Perform the following tests, measurements, or procedures during start-up and as specified in manufacturer's instructions. Ensure device and system which drive is serving is configured to withstand the device operation specified below.
1. Adjust the 'Minimum Voltage Adjustment' to enable starting but not to draw excessive power at start.
  2. Adjust the 'Volts/Hz Adjustment' to proper setting.
  3. Adjust the 'Acceleration and Deceleration Rates' to the specified times.
  4. Adjust 'Current Limiting' to coordinate with the overcurrent device and protect the motor.
  5. Set the 'Maximum and Minimum Speed' pots.
  6. Manually ramp fan speed from minimum to maximum and check for excessive noise and vibration.
  7. Determine any critical speeds to avoid and set these in the drive.
  8. Check for acceptable voltage and current distortion on the power system. Record the input and output voltages and currents showing the harmonic content as a percentage of the base frequency.
  9. Measure and record overall efficiency at 50%, 75%, and 100%.
  10. Record the motor terminal voltage.
- E. Training: Train Owner's maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventative maintenance. Review data in manufacturer's Operation and Maintenance Manuals.

### 3.12 CONTROLLERS AND CONTROL PANELS

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.
- B. Start-Up Checks: Perform the following checks during start-up:
1. Ensure devices are properly installed with adequate clearance for maintenance and with clear labels in accordance with the record drawings.
  2. Ensure that terminations are safe, secure and labeled in accordance with the record drawings.
  3. Check power supplies for proper voltage ranges and loading.
  4. Ensure that wiring and tubing are run in a neat and workman-like manner, either bound or enclosed in trough.

5. Check for adequate signal strength and acceptable bandwidth utilization on communication networks.
6. Check for stand-alone performance of controllers by disconnecting the controller from the LAN. Verify the event is annunciated at Operator Interfaces. Verify that the controlling LAN reconfigures as specified in the event of a LAN disconnection.
7. Ensure that all outputs and devices fail to their proper positions/states.
8. Ensure that buffered and/or volatile information is retained through power outage.
9. With all system and communications operating normally and all trends functioning, sample and record update/annunciation times for critical alarms fed from the panel to the Operator Interface.
10. Check for adequate grounding of all BAS panels and devices.
11. Run self diagnostic routines and ensure they are functional
12. Check the memory allocation and loading to ensure adequate and excess capacity is available and that it will not affect control functionality.

### 3.13 PLUMBING FIXTURES

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.
- B. Start-Up Checks: Perform the following checks during start-up:
  1. Inspect each installed fixture for damage. Replace damaged fixtures and components.
  2. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.
  3. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
  4. Operate and adjust disposers, hot water dispensers, and controls. Replace damaged and malfunctioning units and controls.
  5. Adjust water pressure at drinking fountains, electric water coolers, and faucets, shower valves, and flushometers having controls, to provide proper flow and stream.
  6. Replace washers of leaking and dripping faucets and stops.
  7. Clean fixtures, fittings, and spout and drain strainers with manufacturers' recommended cleaning methods and materials.

### 3.14 WATER HEATERS

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.

- B. General: Provide the services of a factory-authorized service representative to test and inspect unit installation, provide start-up service, and demonstrate and train Owner's maintenance personnel as specified below.
  - 1. Check for adequate combustion air.
  - 2. Check for piping connections leaks.
  - 3. Check for clear vent.
  - 4. Test and adjust operating and safety controls. Replace damaged and malfunctioning controls and equipment.
- C. Training: Train Owner's maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventative maintenance. Review data in Operating and Maintenance Manuals.

### 3.15 HYDRONIC PIPING

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.
- B. Start-Up Checks: Perform the following checks during start-up:
  - 1. Prepare hydronic and test piping in accordance with applicable Section and ASME B 31.9 and/or B 31.1
  - 2. Flush system with clean water in accordance with applicable Section.
  - 3. Clean strainers.
  - 4. Check expansion tanks to determine that they are not air-bound and that the system is completely full of water.
  - 5. Set automatic fill valves for required system pressure.
  - 6. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).
  - 7. Set and coordinate automatic fill pressure and relief valve settings.
- C. Start-Up Tests: Perform the following tests, measurements, or procedures during start-up:
  - 1. Chemical Treatment: Provide a water analysis prepared by the chemical treatment supplier to determine the type and level of chemicals required for prevention of scale and corrosion. Perform initial treatment after completion of system testing.

### 3.16 ROOM/ZONE CHECKOUT

- A. Include all applicable 'Start-Up Checks Common to All Systems'. Additional Start-Up Checks and Tests are as follows.
- B. Contractor shall complete a checklist acknowledging completion of Div. 22 responsibilities for all rooms. Checklist shall include items such as the following as applicable:
- C. Rooms with Plumbing Fixtures



1. Plumbing fixtures clean and operational.

3.17 SEQUENCING ILLUSTRATION

A. Reference Section 01 91 00.

END OF SECTION 22 08 00

Section 22 11 16

DOMESTIC WATER PIPING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings.
- B. LEED Submittals:
  - 1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
  - 2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
  - 1. Do not interrupt water service without **Architect's, Construction Manager's,**

and **Owner's** written permission.

## **PART 2 - PRODUCTS**

### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61-Annex G. Plastic piping components shall be marked with "NSF-pw."

### 2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
  - 1. MSS SP-123.
  - 2. Cast-copper-alloy, hexagonal-stock body.
  - 3. Ball-and-socket, metal-to-metal seating surfaces.
  - 4. Solder-joint or threaded ends.
- G. Copper Pressure-Seal-Joint Fittings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Viega; Plumbing and Heating Systems.
  - 2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
  - 3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze fitting with stainless-steel grip ring and EPDM-rubber, O-ring seal in each end.
- H. Appurtenances for Grooved-End Copper Tubing:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Victaulic Company.
2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End Copper Tubing:
  - a. Copper-tube dimensions and design similar to AWWA C606.
  - b. Ferrous housing sections.
  - c. EPDM-rubber gaskets suitable for hot and cold water.
  - d. Bolts and nuts.
  - e. Minimum Pressure Rating: 300 psig.

## 2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe:
  1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Standard-Pattern, Mechanical-Joint Fittings:
  1. AWWA C110/A21.10, ductile or gray iron.
  2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Compact-Pattern, Mechanical-Joint Fittings:
  1. AWWA C153/A21.53, ductile iron.
  2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- D. Push-on-Joint, Ductile-Iron Pipe:
  1. AWWA C151/A21.51.
  2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
- E. Standard-Pattern, Push-on-Joint Fittings:
  1. AWWA C110/A21.10, ductile or gray iron.
  2. Gaskets: AWWA C111/A21.11, rubber.
- F. Compact-Pattern, Push-on-Joint Fittings:
  1. AWWA C153/A21.53, ductile iron.
  2. Gaskets: AWWA C111/A21.11, rubber.
- G. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

- H. Appurtenances for Grooved-End, Ductile-Iron Pipe:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Shurjoint Piping Products.
    - b. Star Pipe Products.
    - c. Victaulic Company.
  2. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions that match pipe.
  3. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:
    - a. AWWA C606 for ductile-iron-pipe dimensions.
    - b. Ferrous housing sections.
    - c. EPDM-rubber gaskets suitable for hot and cold water.
    - d. Bolts and nuts.
    - e. Minimum Pressure Rating:
      - 1) NPS 14 to NPS 18: **250 psig.**
      - 2) NPS 20 to NPS 46: **150 psig.**

### **PART 3 - EXECUTION**

#### 3.1 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

#### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- E. Install shutoff valve immediately upstream of each dielectric fitting.

- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- G. Install domestic water piping level without pitch and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- M. Install piping to permit valve servicing.
- N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- O. Install piping free of sags and bends.
- P. Install fittings for changes in direction and branch connections.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- R. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
- S. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."
- T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- I. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- J. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer than 100 Feet if indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 6. NPS 6: 10 feet with 5/8-inch rod.
  - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:



1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
  2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  3. NPS 2: 10 feet with 3/8-inch rod.
  4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
  6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
  7. NPS 6: 12 feet with 3/4-inch rod.
  8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
  2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  3. NPS 2: 10 feet with 3/8-inch rod.
  4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
  6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
  7. NPS 6: 12 feet with 3/4-inch rod.
  8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- J. Install supports for vertical stainless-steel piping every 15 feet.
- K. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
  2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
  3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
  4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  5. NPS 6: 48 inches with 3/4-inch rod.
  6. NPS 8: 48 inches with 7/8-inch rod.
- L. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.
- M. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
  2. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  4. NPS 6: 48 inches with 3/4-inch rod.
  5. NPS 8: 48 inches with 7/8-inch rod.
- N. Install supports for vertical PVC piping every 48 inches.
- O. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
5. NPS 6: 48 inches with 3/4-inch rod.
6. NPS 8: 48 inches with 7/8-inch rod.

P. Install supports for vertical PP piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

Q. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

### 3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:
  - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
  - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
  - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
  - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
  - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
- 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return

- piping to provide hot-water flow in each branch.
- b. Adjust calibrated balancing valves to flows indicated.

- 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
- 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
- 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
- 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.10 CLEANING

#### A. Clean and disinfect potable domestic water piping as follows:

- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
- 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
  - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Fill and isolate system according to either of the following:
    - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
    - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
  - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
  - d. Repeat procedures if biological examination shows contamination.
  - e. Submit water samples in sterile bottles to authorities having jurisdiction.

#### B. Clean non-potable domestic water piping as follows:

- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
- 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
  - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

#### C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:
  - 1. Soft copper tube, ASTM B 88, Type K wrought-copper, solder-joint fittings; and brazed joints.
- E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:
  - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
  - 2. Mechanical-joint, ductile-iron pipe; standard-pattern, mechanical-joint fittings; and mechanical joints.
  - 3. Push-on-joint, ductile-iron pipe; standard-pattern, push-on-joint fittings; and gasketed joints.
  - 4. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
- F. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:
  - 1. Hard or soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- G. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
  - 2. Hard copper tube, ASTM B 88, Type L; Copper Pressure-Seal-Joint Fittings; and press joints.
- H. Aboveground domestic water piping, NPS 2-1/2 to NPS 6, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
  - 2. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.

3.12 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
  - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
  - 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
  - 4. Drain Duty: Hose-end drain valves.
  
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
  
- C. Iron grooved-end valves may be used with grooved-end piping.

End of Section

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Section 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose stations.
9. Hose bibbs.
10. Wall hydrants.
11. Ground hydrants.
12. Post hydrants.
13. Drain valves.
14. Water-hammer arresters.
15. Air vents.
16. Trap-seal primer valves.
17. Trap-seal primer systems.
18. Specialty valves.
19. Flexible connectors.
20. Water meters.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 224000 "Plumbing Fixtures"

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.



- B. Shop Drawings: For domestic water piping specialties.
  - 1. Include diagrams for power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: **125 psig** unless otherwise indicated.

#### 2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
    - b. Cash Acme; a division of Reliance Worldwide Corporation.
    - c. Conbraco Industries, Inc.
    - d. FEBCO; a division of Watts Water Technologies, Inc.
    - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    - f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
  - 2. Standard: ASSE 1001.
  - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
  - 4. Body: Bronze.
  - 5. Inlet and Outlet Connections: Threaded.
  - 6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Arrowhead Brass Products.
  - b. Cash Acme; a division of Reliance Worldwide Corporation.
  - c. Conbraco Industries, Inc.
  - d. Prier Products, Inc.
  - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - f. Woodford Manufacturing Company; a division of WCM Industries, Inc.
  - g. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
  - h. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; a division of Watts Water Technologies, Inc.
  - d. Flomatic Corporation.
  - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Accessories:
  - a. Valves: Ball type, on inlet and outlet.

D. Spill-Resistant Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.
  - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.
4. Size: As indicated on the drawings.
5. Accessories:
  - a. Valves: Ball type, on inlet and outlet.

## 2.4 BACKFLOW PREVENTERS

### A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cash Acme; a division of Reliance Worldwide Corporation.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; a division of Watts Water Technologies, Inc.
  - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Size: As indicated on the drawings
5. Body: Bronze.
6. End Connections: Union, solder joint.
7. Finish: Chrome plated.

### B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; a division of Watts Water Technologies, Inc.
  - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
6. Accessories:
  - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and

- outlet.
  - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
  - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
- C. Double-Check, Backflow-Prevention Assemblies:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
    - b. Conbraco Industries, Inc.
    - c. FEBCO; a division of Watts Water Technologies, Inc.
    - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    - e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
  - 2. Standard: ASSE 1015.
  - 3. Operation: Continuous-pressure applications unless otherwise indicated.
  - 4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
  - 5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
  - 6. Accessories:
    - a. Valves PS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    - b. Valves PS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
- D. Beverage-Dispensing-Equipment Backflow Preventers:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.
    - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    - c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
  - 2. Standard: ASSE 1022.
  - 3. Operation: Continuous-pressure applications.
  - 4. Size: NPS 1/4 or NPS 3/8.
  - 5. Body: Stainless steel.
  - 6. End Connections: Threaded.
- E. Dual-Check-Valve Backflow Preventers:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- a. Cash Acme; a division of Reliance Worldwide Corporation.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; a division of Watts Water Technologies, Inc.
  - d. McDonald, A. Y. Mfg. Co.
  - e. Mueller Co. Ltd.; a subsidiary of Mueller Water Products Inc.
  - f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - g. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1024.
  3. Operation: Continuous-pressure applications.
  4. Size: As indicated on the drawings.
  5. Body: Bronze with union inlet.
- F. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Cash Acme; a division of Reliance Worldwide Corporation.
    - b. Lancer Corporation.
    - c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  2. Standard: ASSE 1032.
  3. Operation: Continuous-pressure applications.
  4. Size: NPS 1/4 or NPS 3/8.
  5. Body: Stainless steel.
  6. End Connections: Threaded.
- G. Hose-Connection Backflow Preventers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Conbraco Industries, Inc.
    - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    - c. Woodford Manufacturing Company; a division of WCM Industries, Inc.
  2. Standard: ASSE 1052.
  3. Operation: Up to 10-foot head of water back pressure.
  4. Inlet Size: NPS 1/2 or NPS 3/4.
  5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
- 2.5 WATER PRESSURE-REDUCING VALVES
- A. Water Regulators:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Cash Acme; a division of Reliance Worldwide Corporation.

- b. Conbraco Industries, Inc.
  - c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - d. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1003.
  3. Pressure Rating: Initial working pressure of 150 psig.
  4. Size: As indicated on the drawings.
  5. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
  6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

## 2.6 BALANCING VALVES

### A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. ITT Corporation; Bell & Gossett Div.
  - c. NIBCO Inc.
  - d. TAC.
  - e. TACO Incorporated.
  - f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
2. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

### B. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Crane Co.; Crane Valve Group; Jenkins Valves.
  - d. Crane Co.; Crane Valve Group; Stockham Div.
  - e. Milwaukee Valve Company.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.

5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

## 2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

### A. Water-Temperature Limiting Devices :

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Conbraco Industries, Inc.
  - b. Leonard Valve Company.
  - c. Powers; a division of Watts Water Technologies, Inc.
  - d. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

### B. Primary, Thermostatic, Water Mixing Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Lawler Manufacturing Company, Inc.
  - b. Leonard Valve Company.
  - c. Powers; a division of Watts Water Technologies, Inc.
  - d. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded inlets and outlet.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

### C. Individual-Fixture, Water Tempering Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Conbraco Industries, Inc.
  - b. Lawler Manufacturing Company, Inc.
  - c. Leonard Valve Company.
  - d. Powers; a division of Watts Water Technologies, Inc.
  - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator

- 
- f. Company.
    - Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
  - 2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
  - 3. Pressure Rating: 125 psig minimum unless otherwise indicated.
  - 4. Body: Bronze body with corrosion-resistant interior components.
  - 5. Temperature Control: Adjustable.
  - 6. Inlets and Outlet: Threaded.
  - 7. Finish: Rough or chrome-plated bronze.
- D. Primary Water Tempering Valves:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Heat-Timer Corporation.
    - b. Holby Valve Co., Inc.
  - 2. Standard: ASSE 1017, thermostatically controlled, water tempering valve, listed as tempering valve.
  - 3. Pressure Rating: 125 psig minimum unless otherwise indicated.
  - 4. Body: Bronze.
  - 5. Temperature Control: Manual.
  - 6. Inlets and Outlet: Threaded.
  - 7. Selected Primary Water Tempering Valve Size: As indicated on the drawings.

## 2.8 STRAINERS FOR DOMESTIC WATER PIPING

### A. Y-Pattern Strainers:

- 1. Pressure Rating: 125 psig minimum unless otherwise indicated.
- 2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
- 3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
- 4. Screen: Stainless steel with round perforations unless otherwise indicated.
- 5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: **0.020 inch.**
  - b. Strainers NPS 2-1/2 to NPS 4: **0.045 inch.**
  - c. Strainers NPS 5 and Larger: **0.10 inch**
- 6. Drain: Factory-installed, hose-end drain valve.

## 2.9 HOSE BIBBS

### A. Hose Bibbs:

- 1. Standard: ASME A112.18.1 for sediment faucets.



2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze or Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.10 WALL HYDRANTS

### A. Non-freeze Wall Hydrants:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Josam Company.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Tyler Pipe; Wade Div.
  - d. Watts Drainage Products.
  - e. Woodford Manufacturing Company; a division of WCM Industries, Inc.
  - f. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
  - g. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: **Polished nickel bronze.**
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): Two with each wall hydrant.

## 2.11 GROUND HYDRANTS

### A. Non-freeze Ground Hydrants:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Josam Company.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Tyler Pipe; Wade Div.
  - d. Watts Drainage Products.
  - e. Woodford Manufacturing Company; a division of WCM Industries, Inc.
  - f. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
  - g. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASME A112.21.3M.
3. Type: Non-freeze, concealed-outlet ground hydrant with box.
4. Operation: Loose key.
5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
6. Inlet: NPS 3/4.
7. Outlet: Garden-hose thread complying with ASME B1.20.7.
8. Drain: Designed with hole to drain into ground when shut off.
9. Box: Deep pattern with cover.
10. Box and Cover Finish: Polished nickel bronze.
11. Operating Key(s): Two with each ground hydrant.
12. Vacuum Breaker: ASSE 1011.

## 2.12 DRAIN VALVES

### A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.13 WATER-HAMMER ARRESTERS

- A. Water-Hammer Arresters:
1. Refer to the Schedule on the Contract Drawings for additional information.
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AMTROL, Inc.
    - b. Josam Company.
    - c. Precision Plumbing Products, Inc.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - e. Tyler Pipe; Wade Div.
    - f. Watts Drainage Products.
    - g. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
  3. Standard: ASSE 1010 or PDI-WH 201.
  4. Type: Copper tube with piston.
  5. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.14 AIR VENTS

- A. To be provided at the top of each domestic hot and cold-water riser.
- B. Bolted-Construction Automatic Air Vents:
1. Body: Bronze.
  2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
  3. Float: Replaceable, corrosion-resistant metal.
  4. Mechanism and Seat: Stainless steel.
  5. Size: NPS 1/2 minimum inlet.
  6. Inlet and Vent Outlet End Connections: Threaded.

2.15 TRAP-SEAL PRIMER DEVICE

- A. Refer to the schedule on the Contract Drawings for additional information.
- B. Supply-Type, Trap-Seal Primer Device:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Precision Plumbing Products, Inc.
    - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    - d. MIFAB, Inc.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

C. Drainage-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

## 2.16 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Precision Plumbing Products, Inc.
2. Standard: ASSE 1044.
3. Piping: NPS 1/2, ASTM B 88, Type L; copper, water tubing.
4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
  - a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Vacuum Breaker: ASSE 1001.
6. Size Outlets: NPS 1/2.

## 2.17 SPECIALTY VALVES

- A. Comply with requirements for general-duty metal valves in Section 220523 "General-Duty Valves for Plumbing Piping."

## 2.18 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flex Pression, Ltd.
  2. Flex-Weld Incorporated.
  3. Hyspan Precision Products, Inc.
  4. Metraflex, Inc.
  5. Unaflex.Universal Metal Hose; a Hyspan company.
- B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
1. Working-Pressure Rating: Minimum 250 psig.
  2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
  3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
1. Working-Pressure Rating: Minimum 250 psig.
  2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
  3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Locate backflow preventers in same room as connected equipment or system.
  2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
  3. Do not install bypass piping around backflow preventers.
- B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- C. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve]. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.
- E. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
1. Install cabinet-type units recessed in or surface mounted on wall as specified.

- F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve and pump.
- G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
- H. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.
  - 1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
- I. Install ground hydrants with 1 cu. yd. of crushed gravel around drain hole. Set ground hydrants with box flush with grade.
- J. Install water-hammer arresters in water piping according to PDI-WH 201.
- K. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.
- L. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- M. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- N. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

### 3.2 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

### 3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Pressure vacuum breakers.

2. Intermediate atmospheric-vent backflow preventers.
  3. Reduced-pressure-principle backflow preventers.
  4. Double-check, backflow-prevention assemblies.
  5. Carbonated-beverage-machine backflow preventers.
  6. Dual-check-valve backflow preventers.
  7. Reduced-pressure-detector, fire-protection, backflow-preventer assemblies.
  8. Double-check, detector-assembly backflow preventers.
  9. Water pressure-reducing valves.
  10. Calibrated balancing valves.
  11. Primary, thermostatic, water mixing valves.
  12. Primary water tempering valves.
  13. Hose stations.
  14. Supply-type, trap-seal primer valves.
  15. Trap-seal primer systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."
- 3.4 FIELD QUALITY CONTROL
- A. Perform the following tests and inspections:
1. Test each **pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check, backflow-prevention assembly** according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.
- 3.5 ADJUSTING
- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

End of Section

Section 22 11 23

DOMESTIC WATER PUMPS

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Horizontally mounted, in-line, close-coupled centrifugal pumps.
  - 2. Vertically mounted, in-line, close-coupled centrifugal pumps.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. LEED Submittals:
  - 1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1, without amendments, Section 7 - "Service Water Heating."

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.



1.6 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

**PART 2 - PRODUCTS**

2.1 Refer to the Plumbing Equipment Schedule on the Contract Drawings for additional information.

2.2 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Armstrong Pumps Inc.
  - 2. Bell & Gossett Domestic Pump; ITT Corporation.
  - 3. PACO Pumps; Grundfos Pumps Corporation, U.S.A.
  - 4. Pentair Pump Group; Aurora Pump.
  - 5. TACO Incorporated.
- C. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.
- D. Pump Construction:
  - 1. Casing: Radially split with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
  - 2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
  - 3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
  - 4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
  - 5. Bearings: Oil-lubricated; bronze-journal or ball type.
  - 6. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

- E. Motor: Single speed, with grease-lubricated ball bearings; and resiliently or rigidly mounted to pump casing.

## 2.3 VERTICALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Armstrong Pumps Inc.
  - 2. Bell & Gossett Domestic Pump; ITT Corporation.
  - 3. Grundfos Pumps Corp.
  - 4. PACO Pumps; Grundfos Pumps Corporation, U.S.A.
  - 5. Pentair Pump Group; Aurora Pump.
  - 6. TACO Incorporated.
- C. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted vertical.
- D. Pump Construction:
  - 1. Casing: Radially split, cast iron, with wear rings and threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections. Include pump manufacturer's base attachment for mounting pump on concrete base.
  - 2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
  - 3. Shaft and Shaft Sleeve: Stainless-steel shaft, with copper-alloy shaft sleeve.
  - 4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
  - 5. Bearings: Oil-lubricated; bronze-journal or ball type.
  - 6. Shaft Coupling: Flexible or rigid type if pump is provided with coupling.
- E. Motor: Single speed, with grease-lubricated ball bearings; and rigidly mounted to pump casing.

## 2.4 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

## 2.5 CONTROLS

- A. Pressure Switches: Electric, adjustable for control of **water-supply** pump.
  - 1. Type: Water-immersion pressure sensor, for installation in piping.
  - 2. Enclosure: NEMA 250, [**Type 4X**].
  - 3. Operation of Pump: On or off.
  - 4. Transformer: Provide if required.
  - 5. Power Requirement: [**120 V, ac**].
  - 6. Settings: Start pump at **<Insert pressure>** and stop pump at **<Insert pressure>**.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

### 3.2 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.
- C. Install horizontally mounted, in-line, separately coupled and close-coupled centrifugal pumps with shaft(s) horizontal.
- D. Install vertically mounted, in-line, close-coupled centrifugal pumps with shaft vertical.
- E. Pump Mounting: Install vertically mounted, in-line, close-coupled centrifugal pumps with cast-iron base mounted on concrete base using [**elastomeric pads**] [**elastomeric mounts**] [**restrained spring isolators**]. Comply with requirements for concrete base specified in [**Section 033000 "Cast-in-Place Concrete."**] [**Section 033053 "Miscellaneous Cast-in-Place Concrete."**]
  - 1. Minimum Deflection: [**1/4 inch**].
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- F. Install continuous-thread hanger rods and spring hangers of size required to support

pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
  2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- G. Install pressure switches in water supply piping.
- H. Install thermostats in hot-water return piping.
- I. Install timers [**on wall in engineer's office**] or as directed by the owner.
- J. Install time-delay relays in piping between water heaters and hot-water storage tanks.

### 3.3 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
    - a. Horizontally mounted, in-line, separately coupled centrifugal pumps.
    - b. Horizontally mounted, in-line, close-coupled centrifugal pumps.
    - c. Vertically mounted, in-line, close-coupled centrifugal pumps.
    - d. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."
  2. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."
  3. Install pressure gage and snubber at suction of each pump and pressure gage and snubber at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- D. Connect [**pressure switches,**] [**thermostats,**] [**time-delay relays,**] [**and**] [**timers**] to pumps that they control.

- E. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

### 3.4 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

### 3.5 STARTUP SERVICE

- A. **Perform** startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Check piping connections for tightness.
  - 3. Clean strainers on suction piping.
  - 4. Set [**pressure switches,**] [**thermostats,**] [**timers,**] [**and**] [**time-delay relays**] for automatic starting and stopping operation of pumps.
  - 5. Perform the following startup checks for each pump before starting:
    - a. Verify bearing lubrication.
    - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    - c. Verify that pump is rotating in the correct direction.
  - 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
  - 7. Start motor.
  - 8. Open discharge valve slowly.
  - 9. Adjust temperature settings on thermostats.
  - 10. Adjust timer settings.

### 3.6 ADJUSTING

- A. Adjust domestic water pumps to function smoothly and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

End of Section

Section 22 13 16

SANITARY WASTE AND VENT PIPING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections:

1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.
2. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.
3. Section 226600 "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Waste, Force-Main Piping: 50 psig.

- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

#### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.
- C. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

#### 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  1. Notify **[Owner]** no fewer than **[two]** days in advance of proposed interruption of sanitary waste service.
  2. Do not proceed with interruption of sanitary waste service without **[Owner's]** written permission.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

#### 2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Fernco Inc.
    - c. Tyler Pipe.
  - 2. Standards: ASTM C 1277 and CISPI 310.
  - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Clamp-All Corp.
    - c. Tyler Pipe.
  - 2. Standards: ASTM C 1277 and ASTM C 1540.
  - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

- A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight class. Include square-cut-grooved or threaded ends matching joining method.
- B. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12, threaded.
- C. Steel Pipe Pressure Fittings:
  - 1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
  - 2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
  - 3. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- D. Cast-Iron Flanges: ASME B16.1, Class 125.



1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

## 2.5 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.
- D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
- E. Copper Pressure Fittings:
  1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- F. Solder: ASTM B 32, lead-free with ASTM B 813, water-flushable flux.

## 2.6 ABS PIPE AND FITTINGS

- A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.
- B. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- C. Solvent Cement: ASTM D 2235.
  1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.7 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solvent Cement: ASTM D 2564.
1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.8 SPECIALTY PIPE FITTINGS

### A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Non-pressure Transition Couplings:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Dallas Specialty & Mfg. Co.
    - 2) Fernco Inc.
    - 3) Mission Rubber Company; a division of MCP Industries, Inc.
  - b. Standard: ASTM C 1173.
  - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - d. Sleeve Materials:
    - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
    - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
    - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Non-pressure Transition Couplings:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Cascade Waterworks Mfg. Co.
  - 2) Mission Rubber Company; a division of MCP Industries, Inc.
  - b. Standard: ASTM C 1460.
  - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
5. Pressure Transition Couplings:
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Cascade Waterworks Mfg. Co.
    - 2) Dresser, Inc.
    - 3) EBAA Iron, Inc.
    - 4) JCM Industries, Inc.
    - 5) Romac Industries, Inc.
    - 6) Smith-Blair, Inc.; a Sensus company.
    - 7) The Ford Meter Box Company, Inc.
    - 8) Viking Johnson.
  - b. Standard: AWWA C219.
  - c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
  - d. Center-Sleeve Material: Carbon steel
  - e. Gasket Material: Natural or synthetic rubber.
  - f. Metal Component Finish: Corrosion-resistant coating or material.
- B. Dielectric Fittings:
1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
  2. Dielectric Unions:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Capitol Manufacturing Company.
      - 2) Central Plastics Company.
      - 3) Hart Industries International, Inc.
      - 4) Jomar International Ltd.
      - 5) McDonald, A. Y. Mfg. Co.
      - 6) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      - 7) Wilkins; a Zurn company.
    - b. Description:
      - 1) Standard: ASSE 1079.
      - 2) Pressure Rating: 150 psig.
      - 3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Capitol Manufacturing Company.
    - 2) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - 3) Wilkins; a Zurn company.
  - b. Description:
    - 1) Standard: ASSE 1079.
    - 2) Factory-fabricated, bolted, companion-flange assembly.
    - 3) Pressure Rating: 150 psig.
    - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
4. Dielectric-Flange Insulating Kits:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Advance Products & Systems, Inc.
    - 2) Calpico, Inc.
    - 3) Pipeline Seal and Insulator, Inc.
  - b. Description:
    - 1) Nonconducting materials for field assembly of companion flanges.
    - 2) Pressure Rating: 150 psig.
    - 3) Gasket: Neoprene or phenolic.
    - 4) Bolt Sleeves: Phenolic or polyethylene.
    - 5) Washers: Phenolic with steel backing washers.
5. Dielectric Nipples:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Elster Perfection.
    - 2) Grinnell Mechanical Products.
    - 3) Precision Plumbing Products, Inc.
    - 4) Victaulic Company.
  - b. Description:
    - 1) Standard: IAPMO PS 66
    - 2) Electroplated steel nipple.
    - 3) Pressure Rating: 300 psig at 225 deg F.
    - 4) End Connections: Male threaded or grooved.
    - 5) Lining: Inert and noncorrosive, propylene.

2.9 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Black or natural.

**PART 3 - EXECUTION**

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

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- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- L. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
  2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- O. Install steel piping according to applicable plumbing code.
- P. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.
- Q. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- R. Install aboveground ABS piping according to ASTM D 2661.
- S. Install aboveground PVC piping according to ASTM D 2665.
- T. Install underground ABS and PVC piping according to ASTM D 2321.
- U. Install engineered soil and waste drainage and vent piping systems as follows:
1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
  2. Solvent Drainage System: Comply with ASSE 1043 and solvent fitting manufacturer's written installation instructions.
  3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- V. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to

sanitary sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- W. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- X. Install force mains at elevations indicated.
- Y. Plumbing Specialties:
1. Install backwater valves in sanitary waster gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
  2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
  3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- Z. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- AA. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- BB. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- CC. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
- 3.3 JOINT CONSTRUCTION
- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
  - B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
  - C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.
- F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- G. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- I. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### 3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in OD's.
  - 2. In Drainage Piping: Shielded, non-pressure transition couplings.
  - 3. In Aboveground Force Main Piping: Fitting-type transition couplings.
  - 4. In Underground Force Main Piping:
    - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
    - b. NPS 2 and Larger: Pressure transition couplings.
- B. Dielectric Fittings:
  - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
  - 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
  - 3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
  - 4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.



### 3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves:
  - 1. Install shutoff valve on each sewage pump discharge.
  - 2. Install gate or full-port ball valve for piping NPS 2 and smaller.
  - 3. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
  - 1. Horizontal Piping: Horizontal backwater valves.
  - 2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
  - 3. Install backwater valves in accessible locations.
  - 4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 6. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer than 100 Feet if indicated: MSS Type 49, spring cushion rolls.
  - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 8. Base of Vertical Piping: MSS Type 52, spring hangers.

- C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
  - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
  - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  - 3. NPS 2: 10 feet with 3/8-inch rod.
  - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  - 5. NPS 3: 12 feet with 1/2-inch rod.
  - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
  - 7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
  - 8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 2: 84 inches with 3/8-inch rod.
  - 2. NPS 3: 96 inches with 1/2-inch rod.
  - 3. NPS 4: 108 inches with 1/2-inch rod.
  - 4. NPS 6: 10 feet with 5/8-inch rod.
- K. Install supports for vertical stainless-steel piping every 10 feet.
- L. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.

5. NPS 6: 10 feet with 5/8-inch rod.
  6. NPS 8: 10 feet with 3/4-inch rod.
- M. Install supports for vertical copper tubing every 10 feet.
- N. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  2. NPS 3: 48 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
  5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- O. Install supports for vertical ABS and PVC piping every 48 inches.
- P. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  5. Install horizontal backwater valves with cleanout cover flush with floor.
  6. Comply with requirements for backwater valves, cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
  7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Connect force-main piping to the following:
1. Sanitary Sewer: To exterior force main.
  2. Sewage Pump: To sewage pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

- F. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.8 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.9 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air

- throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  6. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  4. Prepare reports for tests and required corrective action.

### 3.10 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

### 3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
  1. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
  2. Copper DWV tube, copper drainage fittings, and soldered joints.
  3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
  1. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
  1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
  3. Copper DWV tube, copper drainage fittings, and soldered joints.
    - a. Option for Vent Piping, NPS 2-1/2 and NPS 4: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
  4. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.
- E. Aboveground, vent piping NPS 5 and larger shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; **CISPI heavy-duty** hubless-piping couplings; and coupled joints.
  3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
- G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
- H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be any of the following:
1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  2. Galvanized-steel pipe, pressure fittings, and threaded joints.
- I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 shall be any of the following:
1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  2. Galvanized-steel pipe, pressure fittings, and threaded joints.
- J. Underground sanitary-sewage force mains NPS 4 and smaller shall be any of the following:
1. Hard copper tube, Type L; wrought-copper pressure fittings; and soldered joints.
  2. Ductile-iron, mechanical-joint piping and mechanical joints.
  3. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.
- K. Underground sanitary-sewage force mains NPS 5 and larger shall be any of the following:
1. Hard copper tube, Type L; wrought-copper pressure fittings; and soldered joints.
  2. Ductile-iron, mechanical-joint piping and mechanical joints.
  3. Pressure transition couplings if dissimilar pipe materials.

End of Section

Section 22 13 19

SANITARY WASTE PIPING SPECIALTIES

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Trench drains.
5. Channel drainage systems.
6. Air-admittance valves.
7. Roof flashing assemblies.
8. Through-penetration firestop assemblies.
9. Miscellaneous sanitary drainage piping specialties.
10. Flashing materials.

B. Related Requirements:

1. Section 221423 "Storm Drainage Piping Specialties" for storm drainage piping inside the building, drainage piping specialties, and drains.
2. Section 334100 "Storm Utility Drainage Piping" for storm draining piping and piping specialties outside the building.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene plastic.
- D. PE: Polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.



1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- 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 NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

- A. Coordinate size and location of roof penetrations.

**PART 2 - PRODUCTS**

2.1 BACKWATER VALVES

- A. Horizontal, Cast-Iron Backwater Valves:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
    - d. Tyler Pipe; Wade Div.
    - e. Watts Drainage Products Inc.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
  2. Standard: ASME A112.14.1.
  3. Size: Same as connected piping.
  4. Body: Cast iron.
  5. Cover: Cast iron with bolted or threaded access check valve.
  6. End Connections: Hub and spigot or hubless (match piping jointing method)

7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
  8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.
- B. Drain-Outlet Backwater Valves :
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Josam Company; Josam Div.
    - b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
    - c. Watts Drainage Products Inc.
    - d. Zurn Plumbing Products Group; Specification Drainage Operation.
  2. Size: Same as floor drain outlet.
  3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
  4. Check Valve: Removable ball float.
  5. Inlet: Threaded.
  6. Outlet: Threaded or spigot.

## 2.2 CLEANOUTS

- A. Exposed Metal Cleanouts:
1. ASME A112.36.2M, Cast-Iron Cleanouts:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Josam Company.
      - 2) MIFAB, Inc.
      - 3) Smith, Jay R. Mfg. Co.
      - 4) Tyler Pipe.
      - 5) Watts Drainage Products.
      - 6) Zurn Plumbing Products Group.
    2. Standard: ASME A112.36.2M for cast iron <Insert standard> for cleanout test tee.
    3. Size: Same as connected drainage piping
    4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
    5. Closure: Countersunk , brass plug.
    6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
    7. Closure: Stainless-steel plug with seal.
- B. Metal Floor Cleanouts:
1. ASME A112.36.2M, Cast-Iron Cleanouts:
    - a. Basis-of-Design Product: Subject to compliance with requirements,

provide product indicated on Drawings or comparable product by one of the following:

- 1) Josam Company.
  - 2) Oatey.
  - 3) Sioux Chief Manufacturing Co., Inc.
  - 4) Smith, Jay R. Mfg. Co.
  - 5) Tyler Pipe.
  - 6) Watts Drainage Products.
  - 7) Zurn Plumbing Products Group.
2. Standard: ASME A112.36.2M for [cast-iron soil pipe with cast-iron ferrule heavy-duty, adjustable housing threaded, adjustable housing cleanout.
  3. Size: Same as connected branch.
  4. Type: Cast-iron soil pipe with cast-iron ferrule Heavy-duty, adjustable housing.
  5. Body or Ferrule: Cast iron.
  6. Clamping Device: Required.
  7. Outlet Connection: Inside calk or Spigot.
  8. Closure: [Brass plug with straight threads and gasket, Cast-iron plug.
  9. Adjustable Housing Material: Cast iron with threads.
  10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy
  11. Frame and Cover Shape: Round
  12. Top Loading Classification: Heavy Duty.
  13. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Square, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.3 FLOOR DRAINS

- A. Refer to the Drain Schedule on the Contract Drawings for additional information.

2.4 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Ayrlett, LLC.
  - b. Durgo, Inc.
  - c. Oatey.
  - d. ProSet Systems Inc.
  - e. RectorSeal.
  - f. Studor, Inc.
2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected fixture or branch vent piping.

B. Stack Air-Admittance Valves :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Durgo, Inc.
  - b. Oatey.
  - c. Studor, Inc.
2. Standard: ASSE 1050 for vent stacks.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected stack vent or vent stack.

C. Wall Box:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Durgo, Inc.
  - b. Oatey.
  - c. RectorSeal.
  - d. Studor, Inc.
2. Description: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve.
3. Size: About 9 inches wide by 8 inches high by 4 inches deep.

## 2.5 ROOF FLASHING ASSEMBLIES

### A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Engineering Company; Elmdor/Stoneman Div.
  - b. Thaler Metal Industries Ltd.
2. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
  - a. Open-Top Vent Cap: Without cap.
  - b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
  - c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

## 2.6 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

### A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ProSet Systems Inc.
2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

## 2.7 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

### A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

### B. Deep-Seal Traps:

1. All floor drains to be provided with deep seal traps.
2. Description: Cast-iron or bronze casting, with inlet and outlet matching

3. connected piping and cleanout trap-seal primer valve connection.  
Size: Same as connected waste piping.
  - a. NPS 2: 4-inch- minimum water seal.
  - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- C. Floor-Drain, Trap-Seal Primer Fittings:
  1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
  2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
- D. Air-Gap Fittings:
  1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
  2. Body: Bronze or cast iron.
  3. Inlet: Opening in top of body.
  4. Outlet: Larger than inlet.
  5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- E. Sleeve Flashing Device:
  1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
  2. Size: As required for close fit to riser or stack piping.
- F. Stack Flashing Fittings:
  1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
  2. Size: Same as connected stack vent or vent stack.
- G. Vent Caps:
  1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
  2. Size: Same as connected stack vent or vent stack.
- H. Frost-Resistant Vent Terminals:
  1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
  2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.
- I. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

## 2.8 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
  1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
  2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
  3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
  1. General Applications: 12 oz./sq. ft.
  2. Vent Pipe Flashing: 8 oz./sq. ft.
- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate at base of each vertical soil and waste stack.
  5. Locate at the sewer junction of the building drain not more than 5'-0 from inside or outside the building foundation wall.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
  2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.
- G. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.
- H. Assemble non-ASME A112.3.1, stainless-steel channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
- I. Assemble FRP channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
- J. Assemble plastic channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent



surface.

- K. Install fixture air-admittance valves on fixture drain piping.
- L. Install stack air-admittance valves at top of stack vent and vent stack piping.
- M. Install air-admittance-valve wall boxes recessed in wall.
- N. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- O. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- P. Install through-penetration firestop assemblies in plastic [**conductors**] [**and**] [**stacks**] at floor penetrations.
- Q. Assemble open drain fittings and install with top of hub 2 inches above floor.
- R. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- S. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- T. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- U. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- V. Install vent caps on each vent pipe passing through roof.
- W. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- X. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- Y. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- Z. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
  - 1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
  - 2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
  - 3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.

- 4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
  - AA. Install grease removal devices on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction. Install control panel adjacent to unit, unless otherwise indicated.
  - BB. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing. Coordinate oil-interceptor storage tank and gravity drain with Section 231113 "Facility Fuel-Oil Piping."
  - CC. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.
  - DD. Install wood-blocking reinforcement for wall-mounting-type specialties.
  - EE. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- 3.2 CONNECTIONS
- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
  - B. Install piping adjacent to equipment to allow service and maintenance.
  - C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
  - D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- 3.3 FLASHING INSTALLATION
- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
    - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
    - 2. Copper Sheets: Solder joints of copper sheets.
  - B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
    - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
    - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches

- around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
  - C. Set flashing on floors and roofs in solid coating of bituminous cement.
  - D. Secure flashing into sleeve and specialty clamping ring or device.
  - E. Install flashing for piping passing through roofs with counter-flashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."
  - F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
  - G. Fabricate and install flashing and pans, sumps, and other drainage shapes.
- 3.4 FIELD QUALITY CONTROL
- A. Perform tests and inspections and prepare test reports.
    - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled grease removal devices and their installation, including piping and electrical connections, and to assist in testing.
  - B. Tests and Inspections:
    - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
    - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- 3.5 PROTECTION
- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
  - B. Place plugs in ends of uncompleted piping at end of each day or when work stops.
- 3.6 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain grease removal devices. Refer to Section 017900 "Demonstration and Training."

End of Section

Section 22 14 13

FACILITY STORM DRAINAGE PIPING

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Pipe, tube, and fittings.
- 2. Specialty pipe fittings.

B. Related Sections:

- 1. Section 221429 "Sump Pumps" for storm drainage pumps.
- 2. Section 334100 "Storm Utility Drainage Piping" for storm drainage piping outside the building.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

- 1. Storm Drainage Piping: 10-foot head of water.
- 2. Storm Drainage, Force-Main Piping: 150 psig.

- B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

B. LEED Submittals:

- 1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
- 2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard

Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- C. Shop Drawings: For roof drainage system. Include calculations, plans, and details.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For storm drainage piping, 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. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.
- C. Product Data: For each type of product indicated.

#### 1.7 PROJECT CONDITIONS

- A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify **[Owner]** no fewer than **[two]** days in advance of proposed interruption of storm-drainage service.
  - 2. Do not proceed with interruption of storm-drainage service without **[Owner's]** written permission.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy classes.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Fernco Inc.
    - c. MIFAB, Inc.
    - d. Tyler Pipe.
  - 2. Standards: ASTM C 1277 and CISPI 310.
  - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Clamp-All Corp.
    - c. MIFAB, Inc.
    - d. Tyler Pipe.
  - 2. Standards: ASTM C 1277 and ASTM C 1540.
  - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- D. Cast-Iron, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. MG Piping Products Company.
  - 2. Standard: ASTM C 1277.
  - 3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.4 GALVANIZED-STEEL PIPE AND FITTINGS

- A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight. Include square-cut-grooved or threaded ends matching joining method.
- B. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12 threaded.
- C. Steel-Pipe Pressure Fittings:
  - 1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
  - 2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
  - 3. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- D. Cast-Iron Flanges: ASME B16.1, Class 125.
  - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
  - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

## 2.5 DUCTILE-IRON PIPE AND FITTINGS

- A. Ductile-Iron, Mechanical-Joint Piping:
  - 1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
  - 3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

## 2.6 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
  - 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale

Environmental Chambers."

- D. Solvent Cement: ASTM D 2564.
1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.7 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
  2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
  3. Unshielded, Non-pressure Transition Couplings:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Dallas Specialty & Mfg. Co.
      - 2) Fernco Inc.
      - 3) Mission Rubber Company; a division of MCP Industries, Inc.
    - b. Standard: ASTM C 1173.
    - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - d. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
  4. Shielded, Non-pressure Transition Couplings:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cascade Waterworks Mfg. Co.
      - 2) Mission Rubber Company; a division of MCP Industries, Inc.
    - b. Standard: ASTM C 1460.
    - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-



resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

5. Pressure Transition Couplings:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Cascade Waterworks Mfg. Co.
    - 2) Dresser, Inc.
    - 3) EBAA Iron, Inc.
    - 4) Ford Meter Box Company, Inc. (The)
    - 5) JCM Industries, Inc.
    - 6) Romac Industries, Inc.
    - 7) Smith-Blair, Inc.; a Sensus company.
    - 8) Viking Johnson; c/o Mueller Co.
  - b. Standard: AWWA C219.
  - c. Description: Metal, sleeve-type couplings same size as, with pressure rating at least equal to and ends compatible with, pipes to be joined.
  - d. Center-Sleeve Material: Carbon steel.
  - e. Gasket Material: Natural or synthetic rubber.
  - f. Metal Component Finish: Corrosion-resistant coating or material.

### **PART 3 - EXECUTION**

#### 3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

#### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- L. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- M. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Storm Drain: Slope downward in direction of flow for piping as required by code and per authority having jurisdiction.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- O. Install steel piping according to applicable plumbing code.
- P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- Q. Install aboveground ABS piping according to ASTM D 2661.
- R. Install aboveground PVC piping according to ASTM D 2665.
- S. Install underground PVC piping according to ASTM D 2321.
- T. Install engineered [**controlled-flow**] [**siphonic**] drain specialties and storm drainage piping in locations indicated.
- U. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

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- V. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
  - W. Install force mains at elevations indicated.
  - X. Plumbing Specialties:
    - 1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."
    - 2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
    - 3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."
  - Y. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
  - Z. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
  - AA. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
  - BB. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
- 3.3 JOINT CONSTRUCTION
- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
  - B. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
  - C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
  - D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are

corroded or damaged. Do not use pipe sections that have cracked or open welds.

- E. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- H. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### 3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in OD's.
  - 2. In Drainage Piping: Shielded, non-pressure transition couplings.
  - 3. In Aboveground Force-Main Piping: Fitting-type transition couplings.
  - 4. In Underground Force-Main Piping:
    - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
    - b. NPS 2 and Larger: Pressure transition couplings.

### 3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sump pump discharge.
  - 1. Install gate or full-port ball valve for piping NPS 2 and smaller.
  - 2. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  6. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  2. NPS 3: 60 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
  6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings

is limited to 60 inches.

- G. Install supports for vertical cast-iron soil piping every 15 feet.
  - H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
    - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
    - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
    - 3. NPS 2: 10 feet with 3/8-inch rod.
    - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
    - 5. NPS 3: 12 feet with 1/2-inch rod.
    - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
    - 7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
    - 8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.
  - I. Install supports for vertical steel piping every 15 feet.
  - J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
    - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
    - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
    - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
    - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
    - 5. NPS 6: 10 feet with 5/8-inch rod.
    - 6. NPS 8: 10 feet with 3/4-inch rod.
  - K. Install supports for vertical copper tubing every 10 feet.
  - L. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
    - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
    - 2. NPS 3: 48 inches with 1/2-inch rod.
    - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
    - 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
    - 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
  - M. Install supports for vertical PVC piping every 48 inches.
  - N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.
- 3.7 CONNECTIONS
- A. Drawings indicate general arrangement of piping, fittings, and specialties.
  - B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

- C. Connect storm drainage piping to roof drains and storm drainage specialties.
  - 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
  - 2. Install horizontal backwater valves with cleanout cover flush with floor.
  - 3. Comply with requirements for backwater valves, cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."
- D. Connect force-main piping to the following:
  - 1. Storm Sewer: To exterior force main.
  - 2. Sump Pumps: To sump pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- F. Make connections according to the following unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.8 IDENTIFICATION

- A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.9 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit

2. separate report for each test, complete with diagram of portion of piping tested.
  2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
  4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  5. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  4. Prepare reports for tests and required corrective action.
- 3.10 CLEANING
- A. Clean interior of piping. Remove dirt and debris as work progresses.
  - B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
  - C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- 3.11 PIPING SCHEDULE
- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
  - B. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following:
    1. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, hubless-piping couplings; and coupled joints.
  - C. Aboveground, storm drainage piping NPS 8 and larger shall be any of the following:
    1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
    2. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, hubless-piping couplings; and coupled joints.



- D. Underground storm drainage piping NPS 6 and smaller shall be any of the following:
  - 1. Extra Heavy class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
- E. Underground, storm drainage piping NPS 8 and larger shall be any of the following:
  - 1. **[Extra Heavy] [Service]** class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
- F. Aboveground storm drainage force mains NPS 1-1/2 and NPS 2 shall be any of the following:
  - 1. Hard copper tube, copper pressure fittings, and soldered joints.
  - 2. Galvanized-steel pipe, pressure fittings, and threaded joints.
- G. Aboveground storm drainage force mains NPS 2-1/2 to NPS 6 shall be any of the following:
  - 1. Galvanized-steel pipe, pressure fittings, and threaded joints.
  - 2. Fitting-type transition couplings if dissimilar pipe materials.
- H. Underground storm drainage force mains NPS 4 and smaller shall be any of the following:
  - 1. Ductile-iron, mechanical-joint piping and mechanical joints.
  - 2. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.
- I. Underground storm drainage force mains NPS 5 and larger shall be any of the following:
  - 1. Ductile-iron, mechanical-joint piping and mechanical joints.

End of Section

Section 22 14 23

STORM DRAINAGE PIPING SPECIALTIES

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Roof drains.
- 2. Miscellaneous storm drainage piping specialties.
- 3. Cleanouts.
- 4. Backwater valves.
- 5. Through-penetration firestop assemblies.
- 6. Flashing materials.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

**PART 2 - PRODUCTS**

- 2.1 Refer to the Drain Schedule on the Contract Drawings for additional information.

2.2 METAL ROOF DRAINS

- A. Cast-Iron, Large-Sump, General-Purpose Roof Drains:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Josam Company.
    - b. Smith, Jay R. Mfg. Co.

- c. Tyler Pipe.
- d. Watts Water Technologies, Inc.
- e. Zurn Plumbing Products Group; Specification Drainage Operation.

## 2.3 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

### A. Downspout Adaptors:

- 1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
- 2. Size: Inlet size to match parapet drain outlet.

### B. Downspout Boots:

- 1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
- 2. Size: Inlet size to match downspout and NPS 4 outlet.

### C. Conductor Nozzles:

- 1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
- 2. Size: Same as connected conductor.

## 2.4 CLEANOUTS

### A. Floor Cleanouts:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company.
  - b. Smith, Jay R. Mfg. Co.
  - c. Tyler Pipe.
  - d. Watts Water Technologies, Inc.
  - e. Zurn Plumbing Products Group; Light Commercial Products Operation.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.36.2M, cleanouts.
- 3. Size: Same as connected branch.
- 4. Type: Cast-iron soil pipe with cast-iron ferrule.
- 5. Body or Ferrule Material: Cast iron.
- 6. Clamping Device: Required.
- 7. Outlet Connection: Inside calk.
- 8. Closure: Brass plug with straight threads and gasket.
- 9. Adjustable Housing Material: Cast iron with set-screws or other device.
- 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
- 11. Frame and Cover Shape: Round.
- 12. Top-Loading Classification: Heavy Duty.
- 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to

cleanout.

B. Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company.
  - b. Smith, Jay R. Mfg. Co.
  - c. Tyler Pipe.
  - d. Watts Water Technologies, Inc.
  - e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
3. Size: Same as connected drainage piping.
4. Body Material: Hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

## 2.5 BACKWATER VALVES

A. Cast-Iron, Horizontal Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company.
  - b. Smith, Jay R. Mfg. Co.
  - c. Tyler Pipe.
  - d. Watts Water Technologies, Inc.
  - e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.14.1, for backwater valves.
3. Size: Same as connected piping.
4. Body Material: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: hubless.
7. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
8. Extension: ASTM A 74, Service class; full-size, cast-iron soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Cast-Iron, Drain-Outlet Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Josam Company.
  - b. Smith, Jay R. Mfg. Co.
  - c. Watts Water Technologies, Inc.
  - d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Size: Same as floor drain outlet.
  3. Body Material: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
  4. Check Valve: Removable ball float.
  5. Inlet: Threaded.
  6. Outlet: Threaded or spigot.
  7. **[Medium Duty]**.

## 2.6 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

### A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. ProSet Systems Inc.
  - b. Or approved equal.
3. Standard: ASTM E 814, for through-penetration firestop assemblies.
4. Size: Same as connected pipe.
5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
7. Special Coating: Corrosion resistant on interior of fittings.

## 2.7 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft.
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.
- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

- F. Solder: ASTM B 32, lead-free alloy.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  2. Install expansion joints, if indicated, in roof drain outlets.
  3. Position roof drains for easy access and maintenance.
- B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.
- C. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
- D. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
  3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate cleanouts at base of each vertical soil and waste stack.
  5. Locate at the sewer junction of the building drain not more than 5'-0" from inside or outside the building foundation wall.
- E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- F. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- G. Install horizontal backwater valves in floor with cover flush with floor.
- H. Install drain-outlet backwater valves in outlet of drains.
- I. Install test tees in vertical conductors and near floor.
- J. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- K. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.
- L. Assemble channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

- M. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.
- N. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

### 3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

### 3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
  - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

### 3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

End of Section

Section 22 14 29

SUMP PUMPS

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Submersible sump pumps.
2. Wet-pit-volute sump pumps.
3. Sump-pump basins and basin covers.
4. Packaged drainage-pump units.

B. Related Requirements:

1. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with manufacturer's written instructions for handling.



## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

### 2.2 SUBMERSIBLE SUMP PUMPS

- A. Submersible, Fixed-Position, Single-Seal Sump Pumps:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Stancor, Inc.
    - b. Pentair Pump Group.
    - c. Liberty Pumps.
    - d. Weil Pump Company, Inc.
    - e. Zoeller Company.
  - 2. Description: Factory-assembled and -tested sump-pump unit.
  - 3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
  - 4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
  - 5. Impeller: Statically and dynamically balanced, ASTM A48/A48M, Class No. 25 A cast iron ASTM A532/A532M, abrasion-resistant cast iron and ASTM B584, cast bronze, design for clear wastewater handling, and keyed and secured to shaft.
  - 6. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
  - 7. Seal: Mechanical.
  - 8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
    - a. Motor Housing Fluid: Air.
  - 9. Controls:
    - a. Enclosure: NEMA 250, Type 4X.
    - b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
    - c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
    - d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.

- e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120 V ac, with transformer and contacts for remote alarm bell.

10. Controls:

- a. Enclosure: NEMA 250, Type 4X; wall mounted.
- b. Switch Type: Mechanical-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
- c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
- d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120 V ac, with transformer and contacts for remote alarm bell.

11. Control-Interface Features:

- a. Remote Alarm Contacts: For remote alarm interface.
- b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
  - 1) On-off status of pump.
  - 2) Alarm status.

2.3 SUMP-PUMP CAPACITIES AND CHARACTERISTICS

- A. Capacity: As shown on equipment schedule on drawing P0.02.

2.4 SUMP-PUMP BASINS AND BASIN COVERS

- A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.
  - 1. Material: Fiberglass.
  - 2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
  - 3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.
- B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
  - 1. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.

### **PART 3 - EXECUTION**

#### 3.1 EARTHWORK

- A. Excavation and filling are specified in Section 312000 "Earth Moving."

#### 3.2 EXAMINATION

- A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

#### 3.3 INSTALLATION

- A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

#### 3.4 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to equipment, allow space for service and maintenance.

#### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test, inspect, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections:
  - 1. Perform each visual and mechanical inspection.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Pumps and controls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.6      STARTUP SERVICE

- A.      Engage a factory-authorized service representative to perform startup service.
  - 1.      Complete installation and startup check according to manufacturer's written instructions.

3.7      ADJUSTING

- A.      Adjust pumps to function smoothly and lubricate as recommended by manufacturer.
- B.      Adjust control set points.

3.8      DEMONSTRATION

- A.      Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

End of Section

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Section 22 40 00

PLUMBING FIXTURES

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 RELATED SECTIONS:

- A. Section 220716 "Plumbing Piping Insulation."

1.3 SUMMARY

- A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories, bathtub/showers, showers and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Urinals.
8. Lavatories.
9. Kitchen sinks.
10. Service sinks.
11. Owner-furnished fixtures.
12. Drinking Fountains.

- B. This Section includes the following emergency plumbing fixtures and related components:

- A. Section Includes:
  - 1) Emergency showers.
  - 2) Eyewash equipment.
  - 3) Eye/face wash equipment.
  - 4) Combination units.
  - 5) Supplemental equipment.

6) Water-tempering equipment.

- C. Related Sections include the following:
1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
  2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
  3. Division 22 Section "Drinking Fountains and Water Coolers."
  4. Provisions of general LEED requirements and forms: 018113 "Sustainable Design Requirements."

1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.
- E. Furnish extra materials that match DRINKING FOUNTAIN products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Filter Cartridges: Equal to 200 percent of quantity installed for each type and size indicated, but no fewer than 4 of each.
- F. Furnish extra materials that match EMERGENCY products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Flushing-Fluid Solution: Separate lot and equal to at least 200 percent of amount of solution installed for each self-contained unit.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

- 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. Regulatory Requirements: Comply with applicable requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 101-336, "Americans with Disabilities Act" and California Access Compliance Reference Manual for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61-Annex G, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
  - 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
  - 3. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
  - 4. Stainless-Steel Residential Sinks: ASME A112.19.3.
  - 5. Vitreous-China Fixtures: ASME A112.19.2M.
  - 6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
  - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
  - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
  - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
  - 4. Faucets: ASME A112.18.1.
  - 5. Hose-Connection Vacuum Breakers: ASSE 1011.
  - 6. Hose-Coupling Threads: ASME B1.20.7.
  - 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
  - 8. NSF Potable-Water Materials: NSF 61.
  - 9. Pipe Threads: ASME B1.20.1.
  - 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
  - 11. Supply Fittings: ASME A112.18.1.
  - 12. Brass Waste Fittings: ASME A112.18.2.



- I. 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.
  - 3. Brass Waste Fittings: ASME A112.18.2.
  - 4. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
  
- J. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. ASSE 1008 and UL 430.
  - 2. Air-Gap Fittings: ASSE 1021.
  - 3. Flexible Water Connectors: ASME A112.18.6.
  - 4. Floor Drains: ASME A112.6.3.
  - 5. Hose-Coupling Threads: ASME B1.20.7.
  - 6. Hot-Water Dispensers: ASSE 1023 and UL 499.
  - 7. Off-Floor Fixture Supports: ASME A112.6.1M.
  - 8. Pipe Threads: ASME B1.20.1.
  - 9. Plastic Toilet Seats: ANSI Z124.5.
  - 10. Supply and Drain Protective Shielding Guards: ICC A117.1.
  
- K. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
  
- L. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.
  
- M. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities" Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
  
- N. LEED Submittals:
  - 1. Product Data: Documentation indicating that flow and water consumption requirements comply with Prerequisite WE 1

## PART 2 - PRODUCTS

2.1 REFER TO THE PLUMBING FIXTURE SCHEDULE ON THE CONTRACT DRAWINGS FOR ADDITIONAL INFORMATION.

2.2 LAVATORY FAUCETS

A. Lavatory Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

- a. American Standard Companies, Inc.
- b. Chicago Faucets.
- c. Elkay Manufacturing Co.
- d. Kohler Co.
- e. Sloan Valve Company.
- f. Speakman Company.
- g. T & S Brass and Bronze Works, Inc.
- h. Zurn
- i. Delta

2.3 SINK FAUCETS

A. Sink Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

- A. American Standard Companies, Inc.
- B. Chicago Faucets.
- C. Elkay Manufacturing Co.
- D. Kohler Co.
- E. Speakman Company.
- F. T & S Brass and Bronze Works, Inc.
- G. Zurn
- H. Delta

2.4 FLUSHOMETERS

A. Flushometers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

- A. Coyne & Delany Co.
- B. Sloan Valve Company.
- C. Zurn Plumbing Products Group; Commercial Brass Operation.

2.5 TOILET SEATS

A. Toilet Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

- A. Bemis Manufacturing Company.

- B. Church Seats.
  - C. Kohler Co.
  - D. Olsonite Corp.
2. Description: Toilet seat for water-closet-type fixture.
- A. Material: Molded, solid plastic.
  - B. Configuration: Open front without cover.
  - C. Size: Elongated.
  - D. Hinge Type: SC, self-sustaining, check.
  - E. Class: Heavy-duty commercial.
  - F. Color: White.

## 2.6 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - A. McGuire Manufacturing Co., Inc.
    - B. Plumberex Specialty Products Inc.
    - C. TRUEBRO, Inc.
  - 2. Description: Manufactured plastic insulated wraps for covering plumbing fixture hot-water supply and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
  - 3. To be installed on all Lavatories and sinks designated for handicapped accessible use.

## 2.7 FIXTURE SUPPORTS

- A. Manufacturers:
- 1. Josam Company.
  - 2. Smith, Jay R. Mfg. Co.
  - 3. Tyler Pipe; Wade Div.
  - 4. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Water-Closet Supports:
- 1. Description: Combination carrier designed for accessible or standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space. Products to comply with the requirements of ASME A112.6.1M with a 500 lbs. static load rating.
- C. Urinal Supports:
- 1. Description: Urinal carrier with hanger and bearing plates for wall-mounting, urinal-type fixture. Include steel uprights with feet.

2. Accessible-Fixture Support: Include rectangular steel uprights.

D. Lavatory Supports:

1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.8 INTERCEPTORS

A. Manufacturers:

1. Jensen Precast.
2. Josam Company.
3. MIFAB Manufacturing Inc.
4. Smith, Jay R. Mfg. Co.
5. Tyler Pipe; Wade Div.
6. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
7. Zurn Plumbing Products Group; Specification Drainage Operation.

2.9 WATER CLOSETS

A. Water Closets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - A. American Standard Companies, Inc.
  - B. Kohler Co.
  - C. TOTO USA, Inc.
  - D. Zurn Industries
  - E. Sloan
2. Description: Wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
  - A. Style: Flushometer valve.
    - 1) Bowl Type: Elongated with siphon-jet design.
    - 2) Design Consumption: **[1.28 gal.]** per flush.
    - 3) Color: White.

2.10 URINALS

A. Urinals:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - A. American Standard Companies, Inc.
  - B. Kohler Co.
  - C. TOTO USA, Inc.
  - D. Zurn

- E. Sloan
- 2. Description: Wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
  - A. Type: Siphon jet.
  - B. Strainer or Trapway: With integral trap.
  - C. Design Consumption: **0.125 gal. per flush.**
  - D. Color: White.
  - E. Supply Spud Size: NPS 3/4.
  - F. Outlet Size: NPS 2.

#### 2.11 LAVATORIES

- A. Lavatories, Wall hung:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - A. American Standard Companies, Inc.
    - B. Kohler Co.
    - C. TOTO USA, Inc.
    - D. Zurn
    - E. Sloan
  - 2. Description: Wall-mounting, vitreous-china fixture.

#### 2.12 KITCHEN SINKS

- A. Commercial Sinks:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - A. Elkay Manufacturing Co.
    - B. Just Manufacturing Company.

#### 2.13 SERVICE SINKS

- A. Service Basins:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - A. Fiat
    - B. Florestone Products Co., Inc.
    - C. Precast Terrazzo Enterprises, Inc.
    - D. Stern-Williams Co., Inc.
  - 2. Description: Flush-to-wall, floor-mounting, precast terrazzo fixture with rim guard.

#### 2.14 DRINKING FOUNTAINS

- A. Drinking Fountains: Stainless steel, wall mounted.
  - 1) Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by

one of the following:

- a) Elkay Manufacturing Co.
- b) Filtrine Manufacturing Company.
- c) Halsey Taylor.
- d) Haws Corporation.
- e) Elkay Manufacturing Co.
- f) Filtrine Manufacturing Company.
- g) Halsey Taylor.
- h) Haws Corporation.
- i) Murdock-Super Secur; a division of Acorn Engineering Company.
- j) Stern-Williams Co., Inc.
- k) Crane Plumbing, L.L.C.
- l) Haws Corporation.
- m) Kohler Co.

2) Standards:

- a) Comply with [ASME A112.19.3/CSA B45.4]  
[ASME A112.19.2/CSA B45.1].
- b) Comply with NSF 61.

## 2.15 EMERGENCY SHOWERS

A. Standard, Plumbed Emergency Shower with Eyewash Combination Units:

- 1) Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a) Acorn Safety; a division of Acorn Engineering Company.
  - b) Bradley Corporation.
  - c) Encon Safety Products.
  - d) Guardian Equipment Co.
  - e) Haws Corporation.
  - f) Sellstrom Manufacturing Company.
  - g) Speakman Company.
  - h) WaterSaver Faucet Co.
- 2) Piping:
  - a) Material: **Galvanized steel, Chrome-plated brass or stainless steel**
  - b) Unit Supply: **NPS 1-1/4 minimum.**
  - c) Unit Drain: Outlet at back or side near bottom.
- 3) Shower:
  - a) Capacity: Not less than 20 gpm for at least 15 minutes.
  - b) Supply Piping: NPS 1 with flow regulator and stay-open control valve.
  - c) Control-Valve Actuator: **[Pull rod] [Treadle].**
  - d) Shower Head: 8-inch- minimum diameter, [chrome-plated brass or stainless steel].
  - e) Mounting: Pedestal.
- 4) Eyewash Unit:
  - a) Capacity: Not less than 0.4 gpm for at least 15 minutes.
  - b) Supply Piping: NPS 1/2 with flow regulator and stay-open control valve.

- c) Control-Valve Actuator: Paddle.
- d) Spray-Head Assembly: Two receptor-mounted spray heads.
- e) Receptor: **Chrome-plated brass or stainless-steel** bowl.
- f) Mounting: Attached shower pedestal.
- g) Drench-Hose Option: May be provided instead of eyewash unit.
  - (1) Capacity: Not less than 0.4 gpm for at least 15 minutes.
  - (2) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
  - (3) Mounting: Bracket on shower pedestal.
- B. Accessible, Plumbed Emergency Shower with Eyewash Combination Units:
  - 1) Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a) Acorn Safety; a division of Acorn Engineering Company.
    - b) Bradley Corporation.
    - c) Encon Safety Products.
    - d) Guardian Equipment Co.
    - e) Haws Corporation.
    - f) Sellstrom Manufacturing Company.
    - g) Speakman Company.
    - h) WaterSaver Faucet Co.

## 2.16 WATER-TEMPERING EQUIPMENT

- A. Hot- and Cold-Water, Water-Tempering Equipment:
  - 1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2) Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a) Acorn Safety; a division of Acorn Engineering Company.
    - b) Armstrong International, Inc.
    - c) Bradley Corporation.
    - d) Encon Safety Products.
    - e) Guardian Equipment Co.
    - f) Haws Corporation.
    - g) Lawler Manufacturing Co., Inc.
    - h) Leonard Valve Company.
    - i) Powers; a division of Watts Water Technologies, Inc.
    - j) Speakman Company.
  - 3) Description: Factory-fabricated equipment with thermostatic mixing valve.
    - a) Thermostatic Mixing Valve: Designed to provide 85 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
    - b) Supply Connections: For hot and cold water.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
  - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install wall-mounting fixtures with tubular waste piping attached to supports.
- E. Install water closet base supports securely anchored to floors.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to roughing-in drawings.
- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- K. Install flushometer valves for accessible water closets and urinals with handle mounted



on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

- L. Install toilet seats on water closets.
- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- Q. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- R. Set bathtubs and service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."
- T. Install laminar-flow, faucet-spout fittings in faucet spouts where laminar-flow fittings are specified.
- U. Set freestanding pressure water coolers on floor.
- V. Install thermometers in supply and outlet piping connections to water-tempering equipment for all emergency fixtures. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- W. Fill self-contained fixtures with flushing fluid.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for

Electrical Systems."

- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- E. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Division 22 Section "Domestic Water Piping."
- F. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping. Comply with requirements for waste piping specified in Division 22 Section "Sanitary Waste and Vent Piping."
- G. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.
- H. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

#### 3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed carrier supports to withstand loads of up to 400 lbs.
  - 1. Owner to select up to 10% of the installed carriers to be tested at random.
  - 2. Notify the Owner and Architect at least 48 hours prior to the scheduled testing.
  - 3. Owner to designate an inspector (3rd party QA/QC) whose responsibility it will be to verify that all required examinations and tests have been completed and to inspect the piping to the extent necessary to be satisfied that it conforms to all applicable examination requirements of the applicable codes and this Specification.
  - 4. Owner's inspector and the inspector's delegates shall have access to any place where work concerned with the water closet and carrier installation is being performed. This includes manufacture, fabrication, assembly, erection, examination, and testing of the water closet and carrier.
  - 5. The Subcontractor, fabricator, or manufacturer, as applicable, shall be responsible for quality control examinations as required by this Specification and shall provide the services of an "Examiner" for this purpose.
  - 6. The Subcontractor, fabricator, or manufacturer shall certify records of examination procedures employed, showing dates and results of procedure qualifications, and shall maintain them and make them available to Owner's

inspector.

7. The Examiner has the overall responsibility for defining, identifying, and tracking water closet installations required in process and final inspection in accordance with applicable codes and design specification requirements. The Examiner shall furnish a bi-weekly summary report to the Owner outlining the following:
  - A. Nonconformances identified.
  - B. Status of nonconformance remedies.
  - C. Receiving report for compliance with specification of all water closet materials and components.
  - D. Summary of systems/load rating testing status.
- E. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- F. Install fresh batteries in sensor-operated mechanisms.
- G. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

### 3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers, hot-water dispensers and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. Install fresh batteries in sensor-operated mechanisms.
- F. Adjust fixture flow regulators for proper flow and stream height.
- G. Adjust pressure water-cooler temperature settings.
- H. Adjust or replace fixture flow regulators for proper flow.
- I. Adjust equipment temperature settings.

### 3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.

- 2. Remove sediment and debris from drains.
  - B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.
- 3.7 PROTECTION
- A. Provide protective covering for installed fixtures and fittings.
  - B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

End of Section

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