

**Project Manual for
Wayne State University
School of Social Work
Phase 2
Detroit, Michigan**

**HAA Project No. 2013088.22
WSU Project No. 063-301464**

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SECTION 00 01 10 - TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

1.01 DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

- A. 00 01 10 - Table of Contents

SPECIFICATIONS

2.01 DIVISION 01 -- GENERAL REQUIREMENTS

- A. 01 10 00 - Summary
- B. 01 23 00 - Alternates
- C. 01 31 00 - Project Management and Coordination
- D. 01 32 00 - Construction Progress Documentation
- E. 01 32 33 - Photographic Documentation
- F. 01 33 00 - Submittal Procedures
- G. 01 35 16 - Alteration Project Procedures
- H. 01 40 00 - Quality Requirements
- I. 01 42 00 - References
- J. 01 60 00 - Product Requirements
- K. 01 73 00 - Execution
- L. 01 74 19 - Construction Waste Management and Disposal
- M. 01 77 00 - Closeout Procedures
- N. 01 78 30 - Electronic Files
- O. 01 78 33 - Electronic File Disclaimer Form
- P. 01 78 39 - Project Record Documents
- Q. 01 79 00 - Demonstration and Training

2.02 DIVISION 02 -- EXISTING CONDITIONS

- A. 02 41 19 - Selective Demolition

2.03 DIVISION 03 -- CONCRETE

- A. 03 30 00 - Cast-in-Place Concrete

2.04 DIVISION 04 -- MASONRY

- A. 04 01 10.01 - Masonry Cleaning - ALTERNATE NO. 5
- B. 04 01 20.63 - Brick Masonry Repair
- C. 04 23 00 - Glass Unit Masonry

2.05 DIVISION 05 -- METALS

- A. 05 05 13.13 - Shop-Applied Galvanic Coatings for Metal
- B. 05 31 00 - Steel Decking
- C. 05 50 00 - Metal Fabrications
- D. 05 52 13 - Pipe and Tube Railings

2.06 DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES

- A. 06 10 53 - Miscellaneous Rough Carpentry
- B. 06 20 23 - Interior Finish Carpentry
- C. 06 61 16 - Solid Surface Fabrications

2.07 DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

- A. 07 01 51.71 - Roof Repairs
- B. 07 21 00 - Thermal Insulation
- C. 07 21 29 - Spray-On Insulation
- D. 07 62 00 - Sheet Metal Flashing and Trim
- E. 07 72 00 - Roof Accessories
- F. 07 84 00 - Firestopping
- G. 07 84 13 - Penetration Firestopping
- H. 07 92 00 - Joint Sealants

2.08 DIVISION 08 -- OPENINGS

- A. 08 11 13 - Hollow Metal Doors and Frames
- B. 08 14 16 - Flush Wood Doors
- C. 08 31 13 - Access Doors and Frames
- D. 08 41 13 - Aluminum-Framed Entrances and Storefronts
- E. 08 44 13 - Glazed Aluminum Curtain Walls
- F. 08 71 00 - Door Hardware
- G. 08 80 00 - Glazing
- H. 08 81 17 - Fire-Rated Glass

2.09 DIVISION 09 -- FINISHES

- A. 09 01 90.52 - Maintenance Repainting
- B. 09 22 16 - Non-Structural Metal Framing
- C. 09 29 00 - Gypsum Board
- D. 09 30 13 - Ceramic Tiling
- E. 09 51 13 - Acoustical Panel Ceilings
- F. 09 54 36 - Suspended Decorative Ceilings
- G. 09 65 13 - Resilient Base and Accessories
- H. 09 65 19 - Resilient Tile Flooring
- I. 09 65 43 - Linoleum Flooring
- J. 09 68 13 - Tile Carpeting
- K. 09 72 00 - Wall Coverings
- L. 09 84 47 - Modular Metal Wall System
- M. 09 91 23 - Interior Painting

2.10 DIVISION 10 -- SPECIALTIES

- A. 10 11 00 - Visual Display Units
- B. 10 14 23 - Signage
- C. 10 22 39.01 - Manual Folding Panel Partition - Base Bid for Alternate No. 4
- D. 10 22 39.02 - Electric Folding Panel Partition - Alternate No. 4
- E. 10 28 00 - Toilet, Bath, and Laundry Accessories
- F. 10 44 13 - Fire Protection Cabinets

2.11 DIVISION 11 -- EQUIPMENT

2.12 DIVISION 12 -- FURNISHINGS

- A. 12 24 13 - Roller Window Shades
- B. 12 32 00 - Manufactured Wood Casework

2.13 DIVISION 13 -- SPECIAL CONSTRUCTION

2.14 DIVISION 14 -- CONVEYING EQUIPMENT

2.15 DIVISION 20 -- MECHANICAL GENERAL

- A. 20 05 00 - Mechanical General Requirements
- B. 20 05 10 - Basic Mechanical Materials and Methods
- C. 20 05 13 - Motors
- D. 20 05 29 - Hangers and Supports
- E. 20 05 53 - Mechanical Identification
- F. 20 07 00 - Mechanical Insulation

2.16 DIVISION 21 -- FIRE SUPPRESSION

- A. 21 11 00 - Fire-Suppression System

2.17 DIVISION 22 -- PLUMBING

- A. 22 05 23 - General-Duty Valves for Plumbing Piping
- B. 22 11 16 - Domestic Water Piping
- C. 22 11 19 - Domestic Water Piping Specialties
- D. 22 13 16 - Sanitary Waste and Vent Piping
- E. 22 13 19 - Drainage Piping Specialties
- F. 22 14 13 - Storm Drainage Piping
- G. 22 42 00 - Plumbing Fixtures
- H. 22 47 00 - Drinking Fountains, Water Coolers, and Cuspidors

2.18 DIVISION 23 -- HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

- A. 23 05 00 - Common Work Results for HVAC
- B. 23 05 23 - General-Duty Valves for HVAC
- C. 23 05 93 - Testing, Adjusting, and Balancing
- D. 23 09 33 - Temperature Controls
- E. 23 21 13 - Hydronic Piping
- F. 23 25 10 - Piping systems Flushing and Chemical Cleaning
- G. 23 31 13 - Metal Ducts
- H. 23 33 00 - Duct Accessories
- I. 23 34 23 - Power Ventilators
- J. 23 36 00 - Air Terminal Units
- K. 23 37 13 - Diffusers, Registers, and Grilles
- L. 23 81 20 - Unitary Rooftop Air Conditioners

2.19 DIVISION 26 -- ELECTRICAL

- A. 26 00 10 - Electrical General Requirements
- B. 26 05 19 - Conductors and Cables
- C. 26 05 26 - Grounding and Bonding

- D. 26 05 29 - Hangers and Supports for Electrical Systems
- E. 26 05 33 - Raceways and Boxes
- F. 26 05 53 - Electrical Identification
- G. 26 09 23 - Lighting Control Devices
- H. 26 09 99 - Electrical Testing
- I. 26 27 26 - Wiring Devices
- J. 26 28 13 - Fuses
- K. 26 28 16 - Enclosed Switches and Circuit Breakers
- L. 26 51 19 - LED Interior Lighting
- M. 26 57 00 - Luminaire Product Data Sheets

2.20 DIVISION 27 -- COMMUNICATIONS

- A. 27 05 00 - Telecommunications General Requirements
- B. 27 15 00 - Communications Horizontal Cabling

2.21 DIVISION 28 -- ELECTRONIC SAFETY AND SECURITY

- A. 28 10 00 - Electronic Access Control and Intrusion Detection
- B. 28 2300 - Video Surveillance
- C. 28 31 00 - Fire Alarm

2.22 DIVISION 31 -- EARTHWORK

2.23 DIVISION 32 -- EXTERIOR IMPROVEMENTS

2.24 DIVISION 33 -- UTILITIES

2.25 DIVISION 46 -- WATER AND WASTEWATER EQUIPMENT

END OF SECTION 00 01 10

SECTION 01 10 00 - SUMMARY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Phased construction.
 - 4. Work under separate contracts.
 - 5. Access to site.
 - 6. Coordination with occupants.
 - 7. Work restrictions.
 - 8. Specification and drawing conventions.
 - 9. Miscellaneous provisions.
- B. Related Requirements:
 - 1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.03 PROJECT INFORMATION

- A. Project Identification: School of Social Work.
 - 1. Project Location: 5447 Woodward Ave., Detroit, MI 48201.
- B. Owner: Wayne State University.
 - 1. Owner's Representative: Kidest Albaari.
- C. Architect: Hamilton Anderson Associates.

1.04 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. Renovation of existing building at 5447 Woodward Avenue into office and classroom space for the School of Social Work.
- B. Type of Contract.
 - 1. Project will be constructed under a single prime contract.

1.05 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Preceding Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.
 - 1. Abatement of hazardous materials except as noted below:
 - a. Abatement at windows, storefront and curtainwall to be by General Contractor- refer to hazardous materials reports.

1.06 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site where the Work is indicated for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
 - 1. Contractor to develop plan identifying specific area to be used by the construction trades as a staging area, doors for deliveries, and parking during the construction process. Identify

- locations of temporary fencing to protect the staging area. Plan to be approved by owner prior to mobilization.
2. These areas shall, at completion of the construction process, return to the original condition or be incorporated into the final landscape/ site improvement design.
 3. Portions of the building to remain occupied during construction. Contractor to coordinate schedule and access plan to minimize disturbances of occupied portion of the building. Building is to be made weathertight daily.
- B. Use of Site: Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Driveways, Walkways and Entrances: Keep driveways, parking lots, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.07 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
1. Notify Owner not less than seven days in advance of proposed utility interruptions.
 2. Obtain Owner's written permission before proceeding with utility interruptions.
- C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Owner not less than seven days in advance of proposed disruptive operations.
 2. Obtain Owner's written permission before proceeding with disruptive operations.
- D. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.
- E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.08 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.09 P2 PRODUCTS (NOT USED)

1.10 P3 EXECUTION (NOT USED)

END OF SECTION 01 10 00

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
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SECTION 01 23 00 - ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.

1.02 SCHEDULE OF ALTERNATES

- A. See drawing A0.0 for Alternate Key Plan Diagram
- B. Alternate No. 1 - East Courtyard Build-Out:
 - 1. Base Bid Item: No work to be done in east courtyard
 - 2. Alternate Items: Implement east courtyard build out per Landscape drawings; reference Section 08 71 00 and 28 00 00
- C. Alternate No. 2 - Phase 1 Office Renovations:
 - 1. Base Bid item: No work to be done
 - 2. Alternate Item: Reference drawing numbers A0.0, A1.10, E4.1, M2.0-ALT, M2.1-ALT, M5.2.
- D. Alternate No. 3 - Phase 1 Toilet Room Renovations:
 - 1. Base Bid Item: No work to be done
 - 2. Alternate Item: Reference Drawing numbers A0.0, A1.11, E3.0
- E. Alternate No. 4 - Upgrade Manual Partition to an Electric Operable Partition:
 - 1. Base Bid Item: Section 10 22 39.01 and Drawing number A7.5.4 including detail 10/A7.5.4.
 - 2. Alternate Item: Section 10 22 39.02 and Drawing number A0.0, A7.5.4, E3.0 including detail 10/A7.5.4.
- F. Alternate No. 5 - Perform Masonry Cleaning:
 - 1. Base Bid Item: No masonry cleaning to be performed
 - 2. Alternate items: Perform masonry cleaning; reference Section 04 01 10

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 23 00

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

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SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination drawings.
 - 2. Requests for Information (RFIs).
 - 3. Project meetings.
- B. Related Requirements:
 - 1. Project Manual for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
 - 2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.03 DEFINITIONS

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

1.04 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.05 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.

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

1.06 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.07 REQUESTS FOR INFORMATION (RFIS)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.

3. Date.
 4. Name of Contractor.
 5. Name of Architect and Construction Manager.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: Software-generated form with the same content as indicated above, acceptable to Architect.
- D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect and Construction Manager.
 4. RFI number including RFIs that were dropped and not submitted.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's and/or Construction Manager's response was received.
- F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.08 PROJECT MEETINGS

- A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within three days of the meeting.
- B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 - 1. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of record documents.
 - l. Use of the premises.
 - m. Work restrictions.
 - n. Working hours.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Procedures for moisture and mold control.
 - r. Procedures for disruptions and shutdowns.
 - s. Construction waste management and recycling.
 - t. Parking availability.
 - u. Office, work, and storage areas.
 - v. Equipment deliveries and priorities.
 - w. First aid.
 - x. Security.
 - y. Progress cleaning.
 - 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
 - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Construction Manager will conduct progress meetings at weekly intervals.
1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.

- 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.09 P2 PRODUCTS (NOT USED)

1.10 P3 EXECUTION (NOT USED)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Construction schedule updating reports.
 - 3. Daily construction reports.
 - 4. Site condition reports.
- B. Related Requirements:
 - 1. Refer to Project Manual for preparing a combined Contractor's construction schedule.

1.03 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time belongs to Owner.

1.04 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
- B. Startup construction schedule.
 - 1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- D. Construction Schedule Updating Reports: Submit with Applications for Payment.
- E. Daily Construction Reports: Submit at weekly intervals.
- F. Site Condition Reports: Submit at time of discovery of differing conditions.

1.05 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 PRODUCTS

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
 - 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work under More Than One Contract: Include a separate activity for each contract.
 - 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 4. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 - 5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to the following:
 - a. Submittals.
 - b. Purchases.
 - c. Mockups.
 - d. Fabrication.
 - e. Sample testing.
 - f. Deliveries.
 - g. Installation.
 - h. Tests and inspections.
 - i. Adjusting.
 - j. Curing.

- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:
 - 1. Notice of Award / Notice to Proceed.
 - 2. Mobilize.
 - 3. Start construction.
 - 4. Complete foundations.
 - 5. Temporary enclosure and space conditioning.
 - 6. Complete building enclosure.
 - 7. Complete site improvements and landscaping.
 - 8. Substantial Completion.
 - 9. Final Completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 - 1. Unresolved issues.
 - 2. Unanswered Requests for Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and Contract Time.
- F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.
- G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
 - 1. Use Microsoft Project, Primavera, or Prolog.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for commencement of the Work.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.03 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.
 - 5. Material deliveries.
 - 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 7. Accidents.
 - 8. Meetings and significant decisions.
 - 9. Unusual events.
 - 10. Stoppages, delays, shortages, and losses.
 - 11. Meter readings and similar recordings.
 - 12. Emergency procedures.
 - 13. Orders and requests of authorities having jurisdiction.

14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
- B. Related Requirements:
 - 1. Division 01 Section "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.

1.03 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and relevant building areas with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit unaltered, original, full-size image files within three days of taking photographs.
 - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
 - 2. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Date photograph was taken.
 - d. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1.04 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.05 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, with minimum size of 8 megapixels.

PART 3 EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.

2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect and Construction Manager.
- D. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site, building interior, and surrounding areas, including existing items to remain during construction, from different vantage points, as directed by Architect.
 1. Flag construction limits before taking construction photographs.
 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 3. Take 20 photographs of existing areas either on or adjoining the work area to accurately record physical conditions at start of construction.
 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- E. Periodic Construction Photographs: Take 20 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.
- G. Additional Photographs: Architect or Construction Manager may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
 1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.
 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

END OF SECTION 01 32 33

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 2. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 3. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 4. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.03 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements.

1.04 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1.05 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
 - 1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.
 - c. Conditions: Refer to Division 01 Sections "Electronic CAD Files" and "Data Transfer Forms."
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.
 3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of subcontractor.
 - g. Name of supplier.
 - h. Name of manufacturer.
 - i. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - j. Number and title of appropriate Specification Section.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Other necessary identification.
 4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect or Construction Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.
 5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect and Construction Manager will return without review submittals received from sources other than Contractor.
 - a. Transmittal Form for Paper Submittals: Use AIA Document G810, CSI Form 12.1A, or approved software generated equivalent.
 - b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
 - 1) Project name.
 - 2) Date.
 - 3) Destination (To:).
 - 4) Source (From:).
 - 5) Name and address of Architect.
 - 6) Name of Construction Manager.
 - 7) Name of Contractor.

- 8) Name of firm or entity that prepared submittal.
 - 9) Names of subcontractor, manufacturer, and supplier.
 - 10) Category and type of submittal.
 - 11) Submittal purpose and description.
 - 12) Specification Section number and title.
 - 13) Specification paragraph number or drawing designation and generic name for each of multiple items.
 - 14) Drawing number and detail references, as appropriate.
 - 15) Indication of full or partial submittal.
 - 16) Transmittal number.
 - 17) Submittal and transmittal distribution record.
 - 18) Remarks.
 - 19) Signature of transmitter.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number[, numbered consecutively].
 - q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. Remarks.
 5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.

- c. Manufacturer name.
 - d. Product name.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations: Identify deviations from the Contract Documents on submittals.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

PART 2 PRODUCTS

2.01 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements:
 - 1. Post electronic submittals as PDF electronic files directly to Architect's FTP site specifically established for Project.
 - a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Submit electronic submittals via email as PDF electronic files.
 - a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 3. Action Submittals: Submit PDF electronic files or three paper copies of each submittal unless otherwise indicated. Architect, through Construction Manager, will return annotated file or two paper copies.
 - 4. Informational Submittals: Submit PDF electronic files or two paper copies of each submittal unless otherwise indicated. Architect and Construction Manager will not return copies.
 - 5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.

- g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before or concurrent with Samples.
 - 6. Submit Product Data in the following format:
 - a. PDF electronic file.
 - b. Three paper copies of Product Data unless otherwise indicated. Architect, through Construction Manager, will return two copies.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 - 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
 - b. Two opaque (bond) copies of each submittal. Architect, through Construction Manager, will return one copy.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 - 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Submit product schedule in the following format:
 - a. PDF electronic file.
 - b. Three paper copies of product schedule or list unless otherwise indicated. Architect, through Construction Manager, will return two copies.
- F. Coordination Drawings Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- U. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
- V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.02 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 EXECUTION

3.01 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

- A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 33 00

SECTION 01 35 16 - ALTERATION PROJECT PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes special procedures for alteration work.

1.03 DEFINITIONS

- A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
- B. Consolidate: To strengthen loose or deteriorated materials in place.
- C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.
- D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.
- F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
- G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
- H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
- I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.
- J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.
- K. Retain: To keep existing items that are not to be removed or dismantled.
- L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.04 PROJECT MEETINGS FOR ALTERATION WORK

- A. Preliminary Conference for Alteration Work: Before starting alteration work, Construction Manager will conduct conference at Project site.
 - 1. Attendees: In addition to representatives of Owner, Architect, and Contractor, testing service representative, and chemical-cleaner manufacturer(s) shall be represented at the meeting.
 - 2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:
 - a. Fire-prevention plan.
 - b. Governing regulations.
 - c. Areas where existing construction is to remain and the required protection.
 - d. Hauling routes.
 - e. Sequence of alteration work operations.
 - f. Identification, storage, protection, and accounting for salvaged and specially fabricated items.
 - g. Existing conditions, staging, and structural loading limitations of areas where materials are stored.

- h. Parking
- 3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.

1.05 MATERIALS OWNERSHIP

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1.06 INFORMATIONAL SUBMITTALS

- A. Alteration Work Program: Submit 30 days before work begins.
- B. Fire-Prevention Plan: Submit 30 days before work begins.

1.07 QUALITY ASSURANCE

- A. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.
- B. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.
 - 1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
 - a. Construction activities shall be contained within a "negative pressure" environment. Negative pressure shall not be achieved by using the return air path of an existing or new permanent air handling unit unless the existing ductwork is scheduled for demolition. Dedicated air handling equipment and ducting shall be provided to maintain negative pressurization of the work area throughout the duration of the construction activities, or until such time as the University agrees that the work area presents no recognized hazard to surrounding environments or occupants. Periodic air control monitoring is required.
 - 2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.
- C. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.
 - 1. Reference owner's "hot work" permit requirements which can be found at <http://idrm.wayne.edu/risk/> under the "Fire Safety Manual."
- D. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.08 STORAGE AND HANDLING OF SALVAGED MATERIALS

- A. Salvaged Materials:
 - 1. Review items to be salvaged with owner.
 - 2. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
 - 3. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
 - 4. Store items in a secure area until delivery to Owner.
 - 5. Transport items to Owner's storage area designated by Owner.
 - 6. Protect items from damage during transport and storage.

- B. Salvaged Materials for Reinstallation:
 - 1. Review items to be salvaged with owner.
 - 2. Repair and clean items for reuse as indicated.
 - 3. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
 - 4. Protect items from damage during transport and storage.
 - 5. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.
- C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.
- D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.
 - 1. Identify each item for reinstallation with a non-permanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
 - 2. Secure stored materials to protect from theft.
 - 3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION

3.01 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.
 - 1. Use only proven protection methods, appropriate to each area and surface being protected.
 - 2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
 - 3. Erect temporary barriers to form and maintain fire-egress routes.
 - 4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
 - 5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
 - 6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
 - 7. Protect floors and other surfaces along hauling routes from damage, wear, and staining. Use of elevator requires prior authorization by University.
 - 8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.
- B. Temporary Protection of Materials to Remain:
 - 1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
 - 2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.
- C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
- D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
 2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
 3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.
- E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.
1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.
- F. Existing Roofing: Prior to the start of work in an area, install roofing protection.

3.02 PROTECTION FROM FIRE

- A. General: Follow fire-prevention plan and the following:
1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled "Owner's Responsibility for Fire Protection."
 2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
 - a. If combustible material cannot be removed, provide fire blankets to cover such materials.
- B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:
1. Obtain Owner's approval for operations involving use of welding or other high-heat equipment. Use of open-flame equipment is not permitted. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
 2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
 3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
 4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
 5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
 6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
 - a. Train each fire watch in the proper operation of fire-control equipment and alarms.
 - b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
 - c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.

- d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
 - e. Maintain fire-watch personnel at each area of Project site until 60 minutes after conclusion of daily work.
- C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.
- D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.
 - 1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.03 PROTECTION DURING APPLICATION OF CHEMICALS

- A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.
- B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.
- C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.
- D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.
- E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.04 GENERAL ALTERATION WORK

- A. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs or video recordings. Comply with requirements in Division 01 Section "Photographic Documentation."
- B. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.
- C. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
 - 1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 01 35 16

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

1.03 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.05 INFORMATIONAL SUBMITTALS

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

1.06 THE ORDER OF PRECEDENCE OF DOCUMENTS FOR THE INTERPRETATION OF DESIGN INTENT:

- A. Specifications shall have precedence over all drawings.
- B. Larger Scale drawings shall have precedence over smaller scale drawings.
- C. Schedules and Tables shall have precedence over detail drawings and sections.
- D. Detail drawings and sections shall have precedence over smaller scale drawings.

1.07 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.

9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.08 QUALITY ASSURANCE

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

- H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or Construction Manager.
 - 2. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 6. Demolish and remove mockups when directed unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.09 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

- a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 1. Notify Architect, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Architect, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
 - 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 6. Retesting and reinspecting corrected work.

1.11 P2 PRODUCTS (NOT USED)

PART 3 EXECUTION

2.01 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and Construction Manager's reference during normal working hours.

2.02 REPAIR AND PROTECTION

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

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.03 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.04 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
 - 1. AABC - Associated Air Balance Council; www.aabc.com.
 - 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.

3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
8. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
9. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
10. AF&PA - American Forest & Paper Association; www.afandpa.org.
11. AGA - American Gas Association; www.aga.org.
12. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
13. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
14. AI - Asphalt Institute; www.asphaltinstitute.org.
15. AIA - American Institute of Architects (The); www.aia.org.
16. AISC - American Institute of Steel Construction; www.aisc.org.
17. AISI - American Iron and Steel Institute; www.steel.org.
18. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
19. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
20. ANSI - American National Standards Institute; www.ansi.org.
21. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
22. APA - APA - The Engineered Wood Association; www.apawood.org.
23. APA - Architectural Precast Association; www.archprecast.org.
24. API - American Petroleum Institute; www.api.org.
25. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
26. ARI - American Refrigeration Institute; (See AHRI).
27. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
28. ASCE - American Society of Civil Engineers; www.asce.org.
29. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
30. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
31. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
32. ASSE - American Society of Safety Engineers (The); www.asse.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
35. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
36. AWEA - American Wind Energy Association; www.awea.org.
37. AWI - Architectural Woodwork Institute; www.awinet.org.
38. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
39. AWWA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
40. AWS - American Welding Society; www.aws.org.
41. AWWA - American Water Works Association; www.awwa.org.
42. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
43. BIA - Brick Industry Association (The); www.gobrick.com.
44. BICSI - BICSI, Inc.; www.bicsi.org.
45. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
46. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.

47. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bwfbadminton.org.
48. CDA - Copper Development Association; www.copper.org.
49. CEA - Canadian Electricity Association; www.electricity.ca.
50. CEA - Consumer Electronics Association; www.ce.org.
51. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
52. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
53. CGA - Compressed Gas Association; www.cganet.com.
54. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
55. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
56. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
57. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
58. CPA - Composite Panel Association; www.pbmdf.com.
59. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
60. CRRC - Cool Roof Rating Council; www.coolroofs.org.
61. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
62. CSA - Canadian Standards Association; www.csa.ca.
63. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
64. CSI - Construction Specifications Institute (The); www.csinet.org.
65. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
66. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
67. CWC - Composite Wood Council; (See CPA).
68. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
69. DHI - Door and Hardware Institute; www.dhi.org.
70. ECA - Electronic Components Association; (See ECIA).
71. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
72. ECIA ? Electronic Components Industry Association; www.eciaonline.org.
73. EIA - Electronic Industries Alliance; (See TIA).
74. EIMA - EIFS Industry Members Association; www.eima.com.
75. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
76. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
77. ESTA - Entertainment Services and Technology Association; (See PLASA).
78. EVO - Efficiency Valuation Organization; www.evo-world.org.
79. FIBA - F?d?ration Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
80. FIVB - F?d?ration Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
81. FM Approvals - FM Approvals LLC; www.fmglobal.com.
82. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
83. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarroof.com.
84. FSA - Fluid Sealing Association; www.fluidsealing.com.
85. FSC - Forest Stewardship Council U.S.; www.fscus.org.
86. GA - Gypsum Association; www.gypsum.org.
87. GANA - Glass Association of North America; www.glasswebsite.com.
88. GS - Green Seal; www.greenseal.org.
89. HI - Hydraulic Institute; www.pumps.org.
90. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
91. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
92. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
93. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.

94. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
95. IAS - International Accreditation Service; www.iasonline.org.
96. IAS - International Approval Services; (See CSA).
97. ICBO - International Conference of Building Officials; (See ICC).
98. ICC - International Code Council; www.iccsafe.org.
99. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
100. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
101. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
102. IEC - International Electrotechnical Commission; www.iec.ch.
103. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
104. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
105. IESNA - Illuminating Engineering Society of North America; (See IES).
106. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
107. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
108. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
109. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
110. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
111. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
112. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
113. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
114. ISO - International Organization for Standardization; www.iso.org.
115. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
116. ITU - International Telecommunication Union; www.itu.int/home.
117. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
118. LMA - Laminating Materials Association; (See CPA).
119. LPI - Lightning Protection Institute; www.lightning.org.
120. MBMA - Metal Building Manufacturers Association; www.mbma.com.
121. MCA - Metal Construction Association; www.metalconstruction.org.
122. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
123. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
124. MHIA - Material Handling Industry of America; www.mhia.org.
125. MIA - Marble Institute of America; www.marble-institute.com.
126. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
127. MPI - Master Painters Institute; www.paintinfo.com.
128. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
129. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
130. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
131. NADCA - National Air Duct Cleaners Association; www.nadca.com.
132. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
133. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
134. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
135. NCMA - National Concrete Masonry Association; www.ncma.org.
136. NEBB - National Environmental Balancing Bureau; www.nebb.org.
137. NECA - National Electrical Contractors Association; www.necanet.org.
138. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.

139. NEMA - National Electrical Manufacturers Association; www.nema.org.
140. NETA - InterNational Electrical Testing Association; www.netaworld.org.
141. NFHS - National Federation of State High School Associations; www.nfhs.org.
142. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
143. NFPA - NFPA International; (See NFPA).
144. NFRC - National Fenestration Rating Council; www.nfrc.org.
145. NHLA - National Hardwood Lumber Association; www.nhla.com.
146. NLGA - National Lumber Grades Authority; www.nlga.org.
147. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
148. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
149. NRCA - National Roofing Contractors Association; www.nrca.net.
150. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
151. NSF - NSF International; (National Sanitation Foundation International); www.nsf.org.
152. NSPE - National Society of Professional Engineers; www.nspe.org.
153. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
154. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
155. NWFA - National Wood Flooring Association; www.nwfa.org.
156. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
157. PDI - Plumbing & Drainage Institute; www.pdionline.org.
158. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
159. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
160. RFCI - Resilient Floor Covering Institute; www.rfci.com.
161. RIS - Redwood Inspection Service; www.redwoodinspection.com.
162. SAE - SAE International; (Society of Automotive Engineers); www.sae.org.
163. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
164. SDI - Steel Deck Institute; www.sdi.org.
165. SDI - Steel Door Institute; www.steeldoor.org.
166. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
167. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
168. SIA - Security Industry Association; www.siaonline.org.
169. SJI - Steel Joist Institute; www.steeljoist.org.
170. SMA - Screen Manufacturers Association; www.smainfo.org.
171. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
172. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
173. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
174. SPIB - Southern Pine Inspection Bureau; www.spib.org.
175. SPRI - Single Ply Roofing Industry; www.spri.org.
176. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
177. SSINA - Specialty Steel Industry of North America; www.ssina.com.
178. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
179. STI - Steel Tank Institute; www.steeltank.com.
180. SWI - Steel Window Institute; www.steelwindows.com.
181. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
182. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
183. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America); www.tileusa.com.
184. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
185. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.

186. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
 187. TMS - The Masonry Society; www.masonrysociety.org.
 188. TPI - Truss Plate Institute; www.tpinst.org.
 189. TPI - Turfgrass Producers International; www.turfgrasssod.org.
 190. TRI - Tile Roofing Institute; (Formerly: National Tile Roofing Manufacturing Association); www.tilerroofing.org.
 191. UBC - Uniform Building Code; (See ICC).
 192. UL - Underwriters Laboratories Inc.; www.ul.com.
 193. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
 194. USAV - USA Volleyball; www.usavolleyball.org.
 195. USGBC - U.S. Green Building Council; www.usgbc.org.
 196. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
 197. WASTEC - Waste Equipment Technology Association; www.wastec.org.
 198. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
 199. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
 200. WDMA - Window & Door Manufacturers Association; www.wdma.com.
 201. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); www.wicnet.org.
 202. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
 203. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
 204. WPA - Western Wood Products Association; www.wwpa.org.
- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 3. ICC - International Code Council; www.iccsafe.org.
 4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
1. COE - Army Corps of Engineers; www.usace.army.mil.
 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 4. DOD - Department of Defense; <http://dodssp.daps.dla.mil>.
 5. DOE - Department of Energy; www.energy.gov.
 6. EPA - Environmental Protection Agency; www.epa.gov.
 7. FAA - Federal Aviation Administration; www.faa.gov.
 8. FG - Federal Government Publications; www.gpo.gov.
 9. GSA - General Services Administration; www.gsa.gov.
 10. HUD - Department of Housing and Urban Development; www.hud.gov.
 11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; <http://eetd.lbl.gov>.
 12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 13. SD - Department of State; www.state.gov.
 14. TRB - Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
 15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.

17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice;
www.ojp.usdoj.gov.
 18. USP - U.S. Pharmacopeia; www.usp.org.
 19. USPS - United States Postal Service; www.usps.com.
- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.
1. CFR - Code of Federal Regulations; Available from Government Printing Office;
www.gpo.gov/fdsys.
 2. DOD - Department of Defense; Military Specifications and Standards; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dla.mil>.
 3. DSCC - Defense Supply Center Columbus; (See FS).
 4. FED-STD - Federal Standard; (See FS).
 5. FS - Federal Specification; Available from Department of Defense Single Stock Point;
<http://dodssp.daps.dla.mil>.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide;
www.wbdg.org/ccb.
 6. MILSPEC - Military Specification and Standards; (See DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 3. CDHS; California Department of Health Services; (See CDPH).
 4. CDPH; California Department of Public Health; Indoor Air Quality Program;
www.cal-iaq.org.
 5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
 6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
 7. TFS; Texas Forest Service; Forest Resource Development and Sustainable Forestry;
<http://txforestservice.tamu.edu>.

1.05 P2 PRODUCTS (NOT USED)

1.06 P3 EXECUTION (NOT USED)

END OF SECTION 01 42 00

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Division 01 Section "Substitution Procedures" for requests for substitutions.

1.03 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.04 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.05 QUALITY ASSURANCE

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

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.

1.07 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 - 3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
 4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

2.03 P3 EXECUTION (NOT USED)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
- B. Related Requirements:
 - 1. Division 01 Section "Summary" for limits on use of Project site.
 - 2. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 3. Division 07 Section "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.03 INFORMATIONAL SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Certified Surveys: Submit two copies signed by land surveyor.

1.04 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Mechanical systems piping and ducts.

- f. Control systems.
 - g. Communication systems.
 - h. Fire-detection and -alarm systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction.
- 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Sprayed fire-resistive material.
 - d. Equipment supports.
 - e. Piping, ductwork, vessels, and equipment.
 - f. Noise- and vibration-control elements and systems.
- 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.03 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.04 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.05 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.06 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.08 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.09 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Division 02 Section "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.03 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.04 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of seventy-five (75) percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators

1.05 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

1.06 INFORMATIONAL SUBMITTALS

- A. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- B. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- C. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- D. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

- E. Qualification Data: For waste management coordinator.

1.07 QUALITY ASSURANCE

- A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.08 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

1.09 P2 PRODUCTS (NOT USED)

PART 3 EXECUTION

2.01 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
1. Distribute waste management plan to everyone concerned within three days of submittal return.
 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

2.02 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until installation.
 4. Protect items from damage during transport and storage.
 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale and Donation: Not permitted on Project site.
- C. Salvaged Items for Owner's Use:
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 designated by Owner.

5. Protect items from damage during transport and storage.

2.03 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
- D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
- E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

2.04 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 4. Store components off the ground and protect from the weather.
 5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

2.05 RECYCLING DEMOLITION WASTE

- A. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 1. Pulverize concrete to maximum 4-inch (100-mm) size.
 2. Crush concrete and screen to comply with requirements in Division 31 Section "Earth Moving" for use as satisfactory soil for fill or subbase.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 1. Pulverize masonry to maximum 3/4-inch (19-mm) size.

- a. Crush masonry and screen to comply with requirements in Division 31 Section "Earth Moving" for use as satisfactory soil for fill or subbase.
 - b. Crush masonry and screen to comply with requirements in Division 32 Section "Plants" for use as mineral mulch.
- 2. Clean and stack undamaged, whole masonry units on wood pallets.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- K. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- L. Conduit: Reduce conduit to straight lengths and store by type and size.

2.06 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
 - 1. Comply with requirements in Division 32 Section "Plants" for use of chipped organic waste as organic mulch.
- C. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - a. Comply with requirements in Division 32 Section "Plants." for use of clean sawdust as organic mulch.
- D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
 - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

- a. Comply with requirements in Division 32 Section "Plants." for use of clean ground gypsum board as inorganic soil amendment.

END OF SECTION 01 74 19

WSU School of Social Work Phase 2
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SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Division 01 Section "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 3. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.

1.03 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.04 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.06 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.

3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 5. Submit test/adjust/balance records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
 6. Advise Owner of changeover in heat and other utilities.
 7. Participate with Owner in conducting inspection and walk through with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.07 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report and warranty.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

- B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.08 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A or equivalent.
 - 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - 3. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file. Architect, through Construction Manager, will return annotated copy.
 - b. PDF electronic file. Architect, through Construction Manager, will return annotated copy.

1.09 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 EXECUTION

3.01 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - p. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.

3.02 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 01 78 30 - ELECTRONIC FILES

PART 1 GENERAL

1.01 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.

1.02 DEFINITION

- A. Electronic files are the computer files that are produced using Building Information Management (BIM) software for the development of the Construction Documents. All architecture files produced will be in the Revit 2019 file format and can be exported to Computer Aided Drafting (CAD) files. Consultant files are Computer Aided Drafting (CAD) files are available in AutoCAD 2010.

1.03 SUMMARY

- A. This Section includes administrative and procedural requirements for obtaining electronic files from the design team.

1.04 ELECTRONIC FILES

- A. The design team has produced electronic files in the preparation of the Construction Documents for this project. These files are the property of Hamilton Anderson Associates and their consultants.
- B. To assist a Construction Manager, Contractor, Sub-Contractor, Supplier, or other entity in preparation of their shop drawings and submittals, they may request a copy of the electronic CAD files to use as backgrounds for their work. Those who wish to obtain copies of the most recent electronic CAD files are to follow the procedures outlined in this section.
- C. These files are offered as a convenience to the Construction Manager, Contractor, Sub-Contractor, Supplier, or others and are not to be considered legal documents.

1.05 FILE FORMATS

- A. AutoCAD files produced for the development of Construction Documents will utilize two types of files as listed below:
 - 1. Base Files: Drawings that contain support information for assembling a Sheet File. Typically, a base file will contain line work for plans, elevations and details. These files will only include drawn objects such as wall, doors, windows, ceilings, pavement, and planting areas. They will not include notations such as room name and numbers, door numbers, dimensions, material identifications, and detail identifications. These items are in the Sheet Files.
 - 2. Sheet Files: Drawings that contain all information that is to be plotted such as the title block, various views from the base file (plans, elevations, and details), notations, dimensions, etc.

PART 2 PRODUCTS

2.01 THIS SECTION IS NOT USED.

PART 3 EXECUTION

3.01 REQUESTING FILES

- A. Generally if you are looking for files to use as backgrounds for your layouts (plans and or elevations) you will request the base files that support those items. It is strongly recommended that you contact the Project Architect and or Project Landscape Architect to determine what files are required to fit your needs.
- B. To obtain files you will need to fill out and submit with appropriate payment an ELECTRONIC FILE DISCLAIMER, RELEASE AND LIMITATION OF LIABILITY AGREEMENT form included in this section.

3.02 INFORMATION NOT INCLUDED IN TRANSFERRED FILES

- A. Hamilton Anderson Associates and our consultants reserve the right to not release information in transferred electronic files. The requesting entity must verify information they are seeking is releasable prior to submitting a request. The following items will not be released through electronic data transfer:
1. Drawing title blocks.
 2. Details and or detailed section drawings.
 3. Schedules.

END OF SECTION 01 78 30

SECTION 01 78 33 - ELECTRONIC FILE DISCLAIMER

ELECTRONIC FILE DISCLAIMER, RELEASE AND LIMITATION OF LIABILITY AGREEMENT

HAMILTON ANDERSON ASSOCIATES

HAA PROJECT NO.: 2013088.22

HAA PROJECT NAME: WSU SCHOOL OF SOCIAL WORK - PHASE 2

DATE:

THE INFORMATION CONTAINED IN THE ELECTRONIC FILES FOR THE ABOVE LISTED PROJECT WAS CREATED BY HAMILTON ANDERSON ASSOCIATES. WHILE HAMILTON ANDERSON ASSOCIATES HAS MADE EVERY APPROPRIATE EFFORT TO ASSURE THE ACCURACY OF THESE DOCUMENTS, IT CANNOT GUARANTEE THAT THESE DOCUMENTS CONTAIN COMPLETE AND ACCURATE INFORMATION. THESE DOCUMENTS MUST BE COMPARED TO THE ORIGINAL HARD COPY, WITH STAMPED AND SEALED CERTIFICATION, IN ORDER TO INSURE THE ACCURACY OF THE INFORMATION CONTAINED AND TO FURTHER ENSURE THAT NO CHANGES OR MODIFICATIONS HAVE BEEN MADE TO THE DOCUMENTS.

THE RECIPIENT FURTHER AGREES NOT TO USE THESE DRAWINGS AND/OR DATA, IN WHOLE OR IN PART, FOR ANY PURPOSE OR PROJECT OTHER THAN THE SPECIFIC PROJECT FOR WHICH IT WAS CREATED.

ALL FILES ARE AUTODESK REVIT FILE(S) (*.RVT) OR AUTOCAD FILES (*.DWG). RECEIVER AGREES THAT HAMILTON ANDERSON ASSOCIATES CANNOT PROVIDE THE FILES IN OTHER FILE FORMATS OR COMPRESSED FORMATS AND AGREES TO ACCEPT THE FILE(S) IN THE FORMAT PROVIDED. RECEIVER AGREES THAT HAMILTON ANDERSON ASSOCIATES CANNOT BE HELD RESPONSIBLE FOR PROBLEMS ARISING FROM FILES WHICH HAVE BEEN CONVERTED FOR USE IN NON-NATIVE APPLICATIONS (E.G., AUTOCAD DESIGN FILES TO MICROSTATION).

THE ATTACHED FILES ARE IN A FORMAT THAT CAN BE ALTERED BY THE USER. DUE TO THIS FACT, ANY REUSE OF THE DATA WILL BE AT THE USER'S SOLE RISK WITHOUT LIABILITY OR LEGAL EXPOSURE TO HAMILTON ANDERSON ASSOCIATES, AND USER SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS HAMILTON ANDERSON ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES AND EXPENSES INCLUDING ATTORNEY'S FEES ARISING OUT OF OR RESULTING FROM USING THE DIGITAL FILE.

UNDER NO CIRCUMSTANCES SHALL DELIVERY OF ELECTRONIC FILES FOR USE BY THE UNDERSIGNED BE DEEMED A SALE BY HAMILTON ANDERSON ASSOCIATES, AND HAMILTON ANDERSON ASSOCIATES MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY AND FITNESS OF THESE FILES FOR ANY PARTICULAR PURPOSE. IN NO EVENT SHALL HAMILTON ANDERSON ASSOCIATES BE LIABLE FOR INDIRECT OR CONSEQUENTIAL DAMAGES AS A RESULT OF THE USE OR REUSE OF THE ELECTRONIC FILES.
AGREED

I HAVE READ, UNDERSTAND AND AGREE TO THIS DISCLAIMER/RELEASE/LIMITATION OF LIABILITY, AND I AM AUTHORIZED BY THE RECEIVER NAMED BELOW TO EXECUTE THIS AGREEMENT ON ITS BEHALF.

COMPANY (RECEIVER):

BY NAME:

TITLE:

SIGNATURE:

DATE:

END OF SECTION 01 78 33

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Requirements:
 - 1. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.03 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints and one set of file prints.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record prints and three set(s) of prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

PART 2 PRODUCTS

2.01 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Record data as soon as possible after obtaining it.
 - c. Record and check the markup before enclosing concealed installations.
 - 2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect and Construction Manager.
 - e. Name of Contractor.

2.02 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as paper copy.

2.03 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as paper copy.

2.04 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as paper copy.

PART 3 EXECUTION

3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

END OF SECTION 01 78 39

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.

1.03 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.04 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on compact disc.

1.05 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training.

1.06 COORDINATION

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

PART 2 PRODUCTS

2.01 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
 7. Maintenance: Include the following:
 - a. Inspection procedures.

- b. Types of cleaning agents to be used and methods of cleaning.
- c. List of cleaning agents and methods of cleaning detrimental to product.
- d. Procedures for routine cleaning
- e. Procedures for preventive maintenance.
- f. Procedures for routine maintenance.
- g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 EXECUTION

3.01 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operation and Maintenance Data."

3.02 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.

3.03 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.
- C. Narration: Describe scenes on video recording by audio narration by microphone while dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.

- D. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01 79 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected site elements.
 - 2. Salvage of existing items to be reused or recycled.

1.03 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- C. Existing to Remain: Existing items 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.

1.04 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.05 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.06 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

- D. Predemolition Photographs or Video which documents all work areas: Submit before Work begins.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.07 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: (Hazardous waste only): Hazardous waste removal under separate contract.

1.08 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.09 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials:
 - 1. Reference owner's hazardous materials reports for identification of hazardous materials to be removed by owner before start of work.
 - a. Hazardous material remediation related to window demolition to be provided by Contractor. Reference owner's hazardous materials reports for identification of hazardous materials.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect in the form of a Request for Information (RFI).
- E. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
 - 1. Comply with requirements specified in Division 01 Section "Photographic Documentation."
 - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

3.03 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

3.04 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. 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.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."
- B. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 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.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: 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.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

3.06 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be 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. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.07 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.
- B. At the end of the Work, all interior glass surfaces are to be cleaned.

3.08 SELECTIVE DEMOLITION SCHEDULE

- A. Existing Items and Construction to Be Removed: As indicated on AD series drawings.
- B. Existing Items to Be Removed and Reinstalled: As indicated on AD series drawings.
- C. Existing Items to Remain: As indicated on AD series drawings.

END OF SECTION 02 41 19

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1.04 INFORMATIONAL SUBMITTALS

- A. Material certificates.
- B. Material test reports.
- C. Floor surface flatness and levelness measurements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- C. ACI Publications: Comply 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."
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Preinstallation Conference: Conduct conference at Project site.

PART 2 PRODUCTS

2.01 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

- C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- D. 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."

2.03 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I Type II, option to supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F or C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, graded.
 - 1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M.

2.04 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.05 FIBER REINFORCEMENT

- A. Synthetic Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 inches long.
- B. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 3/4 to 2-1/4 inches long.

2.06 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 (19 by 25 mm).
- B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

2.07 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

2.08 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.09 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.10 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
- D. Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.50
 - 3. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 - 4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent. Provide 6% plus or minus 1% for any exterior or concrete exposed to weather.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.

3.02 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.03 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.04 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.05 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
- E. Waterstops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

3.06 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. 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 to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

- C. Cold-Weather Placement: Comply with ACI 306.1.
- D. Hot-Weather Placement: Comply with ACI 301.

3.07 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to be covered with a coating or covering material applied directly to concrete.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.08 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
 - 1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings, to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated, to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch (6 mm).
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

3.09 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
 - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 03 30 00

SECTION 04 01 10.01 - MASONRY CLEANING - ALTERNATE NO. 5

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes cleaning the following:
 - 1. Unit masonry surfaces.
 - 2. Stone surfaces.

1.03 DEFINITIONS

- A. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.
- B. Medium-Pressure Spray: 400 to 800 psi; 4 to 6 gpm.
- C. High-Pressure Spray: 800 to 1200 psi; 4 to 6 gpm.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 PAINT REMOVERS

- A. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming, alkaline paste or gel formulation, for removing paint from masonry; containing no methylene chloride.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following: ABR Products, Inc.; 800 Fast Acting Grip 'N Strip. Diedrich Technologies Inc., a division of Sandell Construction Solutions; 404 Rip-Strip. Dumond Chemicals, Inc.; Peel Away 1.>
- B. Solvent-Type Paste Paint Remover: Manufacturer's standard water-rinsable, solvent-type paste or gel formulation, for removing paint from masonry.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Diedrich Technologies Inc., a division of Sandell Construction Solutions; 505 Special Coatings Stripper.
 - b. Hydrochemical Techniques, Inc.; HydroClean HT-300 Solvent Paint Remover.
 - c. PROSOCO, Inc.; Sure Klean Fast Acting Stripper.
 - d. Shore Corporation; 2210 SB Paint Remover or 2230 Shore Strip.
- C. Low-Odor, Solvent-Type Paste Paint Remover: Manufacturer's standard low-odor, water-rinsable, solvent-type paste, gel, or foamed emulsion formulation, for removing paint coatings from masonry; containing no methanol or methylene chloride.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABR Products, Inc.; ABR Citrus Paint Removers or Super Bio Strip Gel.
 - b. Cathedral Stone Products, Inc.; S-301, S-303, or S-305.
 - c. Dumond Chemicals, Inc.; Peel Away 7 without paper covering, Smart Strip, or Smart Strip Pro.
 - d. EaCo Chem, Inc.; InStrip.
 - e. PROSOCO, Inc.; Enviro Klean SafStrip or Enviro Klean SafStrip 8.

2.02 CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

- C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.
- D. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal. of solution required.
- E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dumond Chemicals, Inc.; Safe n' Easy Ultimate Stone and Masonry Cleaner.
 - b. Price Research, Ltd.; Price Marble Cleaner-Gel.
 - c. PROSOCO, Inc.; Sure Klean 942 Limestone & Marble Cleaner
- F. 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, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABR Products, Inc.; Building Wash 3.
 - b. Cathedral Stone Products, Inc.; D/2 Biological Solution.
 - c. Diedrich Technologies Inc., a division of Sandell Construction Solutions; Diedrich 910PM Polished Marble/Granite Cleaner.
 - d. Dumond Chemicals, Inc.; Safe n' Easy Architectural Cleaner/Restorer or Safe n' Easy Limestone Cleaner.
 - e. Hydrochemical Techniques, Inc.; HydroClean HT-700 Polished Marble & Granite Cleaner.
 - f. Price Research, Ltd.; Price Non-Acid Masonry Cleaner.
 - g. PROSOCO, Inc.; Stand Off All Surface Cleaner or Stand Off Liquid Marble Cleaner.
- G. Mild-Acid Cleaner: Manufacturer's standard mild-acid cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABR Products, Inc.; X-190 Limestone & Concrete Cleaner.
 - b. Diedrich Technologies Inc., a division of Sandell Construction Solutions; Diedrich 910 Marble Cleaner or Diedrich Envirorestore 100.
 - c. PROSOCO, Inc.; Enviro Klean BioWash or Sure Klean Light Duty Restoration Cleaner

2.03 CHEMICAL CLEANING SOLUTIONS

- A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.

PART 3 EXECUTION

3.01 PROTECTION

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent paint removers and 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 paint removers and chemical cleaners used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents

according to manufacturer's written instructions. Do not apply liquid strippable masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.

2. Repair any areas damaged by cleaning and return to its original state, including landscaping and adjacent surfaces.

3.02 CLEANING MASONRY, GENERAL

- A. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 20 feet away by Architect.
- B. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.
- C. Use only those cleaning methods indicated for each masonry material and location.
 1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
 2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage surfaces, including joints.
 - a. Equip units with pressure gages.
 - b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
 - c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
 - d. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
- D. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces. Keep wall wet below area being cleaned to prevent streaking from runoff.
- E. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to the "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.
- F. Water-Spray Application Method: Unless otherwise indicated, hold spray nozzle at least 6 inches from masonry surface and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- G. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces according to chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
- H. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
 1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.

3.03 PRELIMINARY CLEANING

- A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open joints to whatever depth they occur.

- B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances include paint, calking, asphalt, and tar.
 - 1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
 - 2. Remove paint and calking with alkaline paint remover.
 - a. Comply with requirements in "Paint Removal" Article.
 - b. Repeat application up to two times if needed.
 - 3. Remove asphalt and tar with solvent-type paste paint remover.
 - a. Comply with requirements in "Paint Removal" Article.
 - b. Apply paint remover only to asphalt and tar by brush without prewetting.
 - c. Allow paint remover to remain on surface for 10 to 30 minutes.
 - d. Repeat application if needed.

3.04 PAINT REMOVAL

- A. Paint-Remover Application, General: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
- B. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:
 - 1. Remove loose and peeling paint using low-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - 2. Apply paint remover to dry, painted surface with trowel, spatula, or as recommended in writing by manufacturer.
 - 3. Apply cover according to manufacturer's written instructions.
 - 4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
 - 5. Scrape off paint and remover.
 - 6. Rinse with hot water applied by low-pressure spray to remove chemicals and paint residue.
 - 7. Apply manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended by chemical-cleaner or afterwash manufacturer.
 - 8. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
 - 9. Retreat spots of remaining paint.
- C. Paint Removal with Solvent-Type Paste Paint Remover:
 - 1. Remove loose and peeling paint using low-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - 2. Apply thick coating of paint remover to painted surface with natural-fiber cleaning brush, deep-nap roller, or large paint brush. Apply in one or two coats according to manufacturer's written instructions.
 - 3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
 - 4. Rinse with hot water applied by low-pressure spray to remove chemicals and paint residue.

3.05 CLEANING MASONRY

- A. Detergent Cleaning:
 - 1. Wet surface with water applied by low-pressure spray.
 - 2. Scrub surface 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 surface remains wet.
 - 3. Rinse with water applied by low-pressure spray to remove detergent solution and soil.

- B. Mold, Mildew, and Algae Removal:
 - 1. Wet surface with water applied by low-pressure spray.
 - 2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
 - 3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
 - 4. Rinse with water applied by low-pressure spray to remove mold, mildew, and algae remover and soil.
- C. Nonacidic Gel Chemical Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
 - 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 - 4. Remove bulk of gel cleaner.
 - 5. Rinse with water applied by low-pressure spray to remove chemicals and soil.
- D. Nonacidic Liquid Chemical Cleaning:
 - 1. Wet surface with water applied by low-pressure spray.
 - 2. Apply cleaner to surface in two applications by brush or low-pressure spray.
 - 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 - 4. Rinse with water applied by low-pressure spray to remove chemicals and soil.
- E. Mild-Acid Chemical Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply cleaner to surface in two applications by brush or low-pressure spray.
 - 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 - 4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.

END OF SECTION 04 01 10.01

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
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SECTION 04 01 20.63 - BRICK MASONRY REPAIR

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Repairing brick masonry, including replacing units.
 - 2. Removing abandoned anchors.
 - 3. Painting steel uncovered during the work.

1.03 REFERENCES

- A. U.S. Department of the Interior, National Park Service:
 - 1. Preservation Brief No. 2 - Repointing Mortar Joints in Historic Brick Buildings.

1.04 DEFINITIONS

- A. Defective Mortar Joints: Joints in which mortar is missing, loose, spalled, eroded, powdered, broken, hollow, unsound, soft, or weathered more than 3/16 inch from original plane. Sound joints containing fine hairline cracks are excluded.
- B. Deteriorated Brick: Brick exhibiting deterioration and damage as described in "A Glossary of Historic Masonry Deterioration Problems and Preservation Treatments"; Department of the Interior, National Park Service, Preservation Assistance Division.
- C. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
- D. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.
- E. Saturation Coefficient: Ratio of the weight of water absorbed during immersion in cold water to weight absorbed during immersion in boiling water; used as an indication of resistance of masonry units to freezing and thawing.

1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.06 SEQUENCING AND SCHEDULING

- A. Work Sequence: Perform brick masonry repair work in the following sequence, which includes work specified in this and other Sections:
 - 1. Remove plant growth.
 - 2. Inspect masonry for open mortar joints and point them before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 - 3. Clean masonry.
 - 4. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
 - 5. Repair masonry, including replacing existing masonry with new masonry materials.
 - 6. Rake out mortar from joints to be repointed.
 - 7. Point mortar and sealant joints.
 - 8. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.
- B. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units according to "Masonry Unit Patching" Article. Patch holes in mortar joints according to Section 040120.64 "Brick Masonry Repointing."

1.07 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.
- B. Samples for Initial Selection: For the following:
 1. Colored Mortar: Submit sets of mortar that will be left exposed in the form of sample mortar strips, 6 inches (150 mm) long set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least five samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and source 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 masonry representative of the range of masonry colors on the building.
 - a. Have each set contain a close color range of at least five Samples of different mixes of patching compound that matches the variations in existing masonry when cured and dry.
 3. Include similar Samples of accessories involving color selection.
- C. Samples for Verification: For the following:
 1. Each type of brick unit to be used for replacing existing units. Include sets of Samples to show the full range of shape, color, and texture to be expected. For each brick type, provide straps or panels containing at least four bricks. Include multiple straps for brick with a wide range.
 2. Each type of patching compound in the form of briquettes, at least 3 inches (75 mm) long by 1-1/2 inches (38 mm) wide. Document each Sample with manufacturer and stock number or other information necessary to order additional material.
 3. Accessories: Each type of accessory and miscellaneous support.

1.08 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For brick masonry repair specialist.
- B. Preconstruction Test Reports: For existing masonry units and mortar and replacement masonry units.
- C. Quality-control program.

1.09 QUALITY ASSURANCE

- A. Brick Masonry Repair Specialist Qualifications: Engage an experienced brick masonry repair firm to perform work of this Section. 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. Experience in only installing masonry is insufficient experience for masonry repair work.
 1. Field Supervision: Brick masonry repair specialist firm shall maintain experienced full-time supervisors on Project site during times that brick masonry repair work is in progress.
 2. Brick Masonry Repair Worker Qualifications: When masonry units are being patched, assign at least one worker per crew who is trained and certified by manufacturer of patching compound to apply its products.
- B. 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.
- C. Mockups: Prepare mockups of brick masonry repair to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.

1. Masonry Repair: Prepare sample areas for each type of masonry repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches (1200 mm) in least dimension. Construct sample areas in locations in existing walls where directed by Architect unless otherwise indicated. Demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
 - a. Replacement: Four brick units replaced.
 - b. Patching: Three small holes as directed for each type of brick indicated to be patched.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on masonry units as follows:
 1. Provide test specimens as indicated and representative of proposed materials and existing construction.
 2. Replacement Brick: Test each proposed type of replacement masonry unit according to sampling and testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, five-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).
 3. Existing Brick: Test each type of existing masonry unit indicated for replacement according to testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, five-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove five existing units from locations designated by Architect. Take testing samples from these units.
 4. Existing Mortar: Test according to ASTM C 295/C 295M, 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.
 5. Temporary Patch: As directed by Architect, provide temporary materials followed by permanent repairs at locations from which existing samples were taken.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons and protected against impact and chipping.
- B. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. 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.
- E. Store sand where grading and other required characteristics can be maintained and contamination avoided.
- F. Handle masonry units to prevent overstressing, chipping, defacement, and other damage.

1.12 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit brick masonry repair work to be performed according to product manufacturers' written instructions and specified requirements.

- B. Temperature Limits, General: Repair masonry units only when air temperature is between 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least seven days after completion of the Work unless otherwise indicated.
- C. Cold-Weather Requirements: Comply with the following procedures for masonry repair unless otherwise indicated:
 - 1. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between 40 and 120 deg F (4 and 49 deg C).
 - 2. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for seven days after repair.
- D. Hot-Weather Requirements: Protect masonry repairs when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks, and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above unless otherwise indicated.
- E. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

- A. Source Limitations: Obtain each type of material for repairing brick masonry (brick, cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.02 MASONRY MATERIALS

- A. Face Brick: As required to complete brick masonry repair work.
 - 1. Brick Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork and with physical properties within 10 percent of those determined from preconstruction testing of selected existing units.
 - a. Physical Properties: According to ASTM C 67 and as follows:
 - 1) Compressive Strength: To be determined from preconstruction testing.
 - 2) 24-Hour Cold-Water Submersion Absorption: To be determined from preconstruction testing.
 - 3) Five-Hour Boil Absorption: To be determined from preconstruction testing.
 - 4) Saturation Coefficient: To be determined from preconstruction testing.
 - 5) Initial Rate of Absorption: To be determined from preconstruction testing.
 - b. For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.
 - 2. Special Shapes:
 - a. Provide molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position and where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - b. Provide specially ground units, shaped to match patterns, for arches and where indicated.
 - c. Mechanical chopping or breaking brick, or bonding pieces of brick together by adhesive, are unacceptable procedures for fabricating special shapes.
 - 3. Tolerances as Fabricated: According to tolerance requirements in ASTM C 216, Type FBX.
- B. Building Brick (for back-up wythes): ASTM C 62, of same vertical dimension as face brick, for masonry work concealed from view.

1. Grade SW where in contact with earth.
2. Grade SW or MW for concealed backup.

2.03 MORTAR MATERIALS

- A. Mortar: As specified in Section 040120.64 "Brick Masonry Repointing."

2.04 MANUFACTURED REPAIR MATERIALS

- A. Brick Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching brick masonry.
1. Use formulation that is vapor and water permeable (equal to or more than the masonry unit), exhibits low shrinkage, has lower modulus of elasticity than masonry units being repaired, and develops high bond strength to all types of masonry.
 2. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
 3. Formulate patching compound in colors and textures to match each masonry unit being patched. Provide sufficient number of colors to enable matching of the color, texture, and variation of each unit.

2.05 ACCESSORY MATERIALS

- A. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and bed depths of masonry units, less the required depth of pointing materials unless removed before pointing.
- B. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- C. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer according to SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.
1. Surface Preparation: Use coating requiring no better than SSPC-SP 3, "Power Tool Cleaning" surface preparation according to manufacturer's literature or certified statement.
 2. VOC Limit: Use coating with a VOC content of 400 g/L (3.3 lb/gal.) or less.
- D. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
1. Previous effectiveness in performing the work involved.
 2. Minimal possibility of damaging exposed surfaces.
 3. Consistency of each application.
 4. Uniformity of the resulting overall appearance.
 5. Do not use products or tools that could leave residue on surfaces.

PART 3 EXECUTION

3.01 PROTECTION

- A. Prevent mortar from staining face of surrounding masonry and other surfaces.
1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
 2. Keep wall area wet below rebuilding and repair work to discourage mortar from adhering.
 3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.
- B. Remove gutters and downspouts and associated hardware adjacent to masonry and store during masonry repair. Reinstall when repairs are complete.
1. Provide temporary rain drainage during work to direct water away from building.

3.02 MASONRY REPAIR, GENERAL

- A. Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 20 feet (6 m) away by Architect.

3.03 ABANDONED ANCHOR REMOVAL

- A. Remove abandoned anchors, brackets, wood nailers, and other extraneous items no longer in use unless indicated to remain.

1. Remove items carefully to avoid spalling or cracking masonry.
2. Notify Architect before proceeding if an item cannot be removed without damaging surrounding masonry. Do the following where directed:
 - a. Cut or grind off item approximately 3/4 inch (20 mm) beneath surface and core drill a recess of same depth in surrounding masonry as close around item as practical.
 - b. Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
3. Patch hole where each item was removed unless directed to remove and replace masonry unit.

3.04 BRICK REMOVAL AND REPLACEMENT

- A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 1. When removing single bricks, remove material from center of brick and work toward outside edges.
- B. Support and protect remaining masonry that surrounds removal area.
- C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition. Coordinate with new flashing, reinforcement, and lintels, which are specified in other Sections.
- D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- E. Remove in an undamaged condition as many whole bricks as possible.
 1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
 2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
 3. Store brick for reuse. Store off ground, on skids, and protected from weather.
 4. Deliver cleaned brick not required for reuse to Owner unless otherwise indicated.
- F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.
- G. Replace removed damaged brick with other removed brick in good condition, where possible, or with new brick matching existing brick. Do not use broken units unless they can be cut to usable size.
- H. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
 1. Maintain joint width for replacement units to match existing joints.
 2. Use setting buttons or shims to set units accurately spaced with uniform joints.
- I. Lay replacement brick with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. (30 g/194 sq. cm per min.) Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
 1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
 2. Rake out mortar used for laying brick before mortar sets according to Section 040120.64 "Brick Masonry Repointing." Point at same time as repointing of surrounding area.
 3. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.
- J. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.05 PAINTING STEEL UNCOVERED DURING THE WORK

- A. Notify Architect if steel is exposed during masonry removal. Where Architect determines that steel is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:
 1. Surface Preparation: Remove paint, rust, and other contaminants according to SSPC-SP 2, "Hand Tool Cleaning", as applicable to comply with paint manufacturer's recommended preparation.
 2. Antirust Coating: Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).
- B. If on inspection and rust removal, the thickness of a steel member is found to be reduced from rust by more than 1/16 inch (1.6 mm), notify Architect before proceeding.

3.06 MASONRY UNIT PATCHING

- A. Patch the following masonry units unless another type of repair or replacement is indicated:
 1. Units indicated to be patched.
 2. Units with holes.
 3. Units with chipped edges or corners. Patch chipped edges or corners measuring more than 3/4 inch (19 mm) in least dimension.
 4. Units with small areas of deep deterioration. Patch deep deteriorations measuring more than 3/4 inch (19 mm) in least dimension and more than 1/4 inch (6 mm) deep.
- B. Remove and replace existing patches where indicated.
- C. Patching Bricks:
 1. Remove loose material from masonry surface. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch (6 mm) thick, but not less than recommended in writing by patching compound manufacturer.
 2. Mask adjacent mortar joint or rake out for repointing if patch extends to edge of masonry unit.
 3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
 4. Rinse surface to be patched and leave damp, but without standing water.
 5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
 6. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
 7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
 8. Keep each layer damp for 72 hours or until patching compound has set.
 9. Remove and replace patches with hairline cracks or that show separation from brick at edges, and those that do not match adjoining brick in color or texture.

3.07 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
 1. Do not use metal scrapers or brushes.
 2. Do not use acidic or alkaline cleaners.

- B. Clean adjacent nonmasonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Remove masking materials, leaving no residues that could trap dirt.

3.08 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
- B. Architect's Project Representatives: Architect will assign Project representatives to help carry out Architect's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
- C. Notify inspectors and Architect's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors and Architect's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

3.09 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property.
- B. Masonry Waste: Remove masonry waste and legally dispose of off Owner's property.

END OF SECTION 04 01 20.63

SECTION 04 23 00 - GLASS UNIT MASONRY

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 04 05 11 - Mortar and Masonry Grout: Mortar for glass unit masonry.

1.02 REFERENCE STANDARDS

- A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2013.
- B. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

1.03 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 GLASS UNITS

- A. Utilized salvaged glass units.

2.02 MORTAR AND POINTING MATERIAL

- A. Mortar: ASTM C270, Type M using the Proportion specification as specified in Section 04 05 11.
- B. Pointing Mortar: ASTM C270, Type M using the Proportion specification with maximum 2 percent ammonium stearate or calcium stearate per cement weight, with beach sand aggregate.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Erect glass units and accessories in accordance with manufacturer's instructions.
- B. Pointing With Mortar:
 - 1. Before mortar sets, rake out joints to depth of 5/8 to 3/4 inch.
 - 2. Fill joints with pointing mortar; press into joint to eliminate voids; neatly tool surface to a concave profile.
 - 3. Remove excess pointing mortar.

END OF SECTION 04 23 00

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 05 05 13.13 - SHOP-APPLIED GALVANIC COATINGS FOR METAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes hot-dip galvanizing after manufacture or fabrication of iron and steel materials specified in other sections.

1.03 QUALITY ASSURANCE

- A. Coating Applicator: Company specializing in hot-dip galvanizing after fabrication and following the procedures of the Quality Assurance Manual of the American Galvanizers Association.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel material for galvanizing shall be structural shapes, pipe, sheet, fabrications and assemblies geometrically suitable for galvanizing as described in ASTM A 384 and ASTM A 385.
- B. Steel material shall be chemically suitable for galvanizing.
- C. Zinc for Galvanizing: Conform to ASTM B 6.
 - 1. The composition of metal in the galvanizing bath shall not be less than 98% zinc.
- D. Galvanizing Repair Paint: Inorganic zinc-rich primer; one of the following:
 - 1. MPI#19.
 - 2. SSPC-Paint 20, Type 1.
 - 3. ASTM A 780.
 - 4. SSPC-Paint 30.

2.02 FABRICATION REQUIREMENTS

- A. Fabricate structural steel in accordance with Class I, II, III guidelines as described in AGA's "Recommended Details for Galvanized Structures."
- B. Fabricate products in accordance with the applicable portions of ASTM A 143, ASTM A 384, and ASTM A 385, except as specified herein. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
- C. Notify the Architect/Engineer and hot-dip galvanizer regarding potential problems or potential handling problems during the galvanizing process that may require modification of design before fabrication proceeds.
- D. Remove all welding slag, splatter, anti-splatter compounds and burrs prior to delivery for galvanizing.
 - 1. Avoid the use of high silicon welding rods for welds that are to be galvanized.
- E. Provide holes and/or lifting lugs to facilitate handling during galvanizing.
- F. Avoid unsuitable marking paints. Use only water-soluble markers. Consult with the galvanizer about removal of grease, oil paint and other deleterious material prior to fabrication.
- G. Remove, by blast cleaning or other methods, surface contaminants and coatings that would not be removable by the normal chemical cleaning process in the galvanizing operation.
- H. Whenever possible, fabricate items with slip joints to minimize field welding of material.

PART 3 EXECUTION

3.01 GALVANIZING

- A. Hot-dip galvanize the following steel members as specified herein:

1. Steel members exposed to the exterior environment in the finished construction.
 2. Steel members completely or partially built into exterior wall assemblies and located in areas outside the moisture resistant envelope subject to periodic wetting.
 - a. Galvanize lintels, shelf angles, and other masonry supports including loose members and members attached to structural-steel frame, located in walls exposed to the exterior environment in the finished construction.
 3. Interior steel members where specified and as indicated on Drawings.
- B. Inorganic, zinc-rich, primer may be applied instead of hot-dip galvanizing, at Contractor's option, when steel members scheduled to be galvanized exceed galvanizing tank size capacity or when field erection conditions prevent the use of hotdip galvanized members. Refer to Division 05 Section "Shop-Applied Prime Coatings For Metal."

3.02 COATING APPLICATION

- A. Galvanize steel members, fabrications and assemblies after fabrication by the hot-dip process in accordance with ASTM A 123.
- B. Galvanize bolts, nuts and washers and iron and steel hardware components in accordance with ASTM A 153 in a kettle capable of reaching 1000 degrees Fahrenheit.
- C. Galvanize reinforcing steel in accordance with ASTM A 767.
- D. Safeguard products against steel embrittlement in conformance with ASTM A 143.
- E. Use of the "wet method" process of galvanizing, involving a flux blanket on the kettle is prohibited.
- F. Coat in a single dip steel items less than 60 feet long by 4 feet wide by 9 feet deep, in order to minimize potential distortion. Double dip larger items.
- G. Where galvanized articles are indicated to be painted, do not quench in water containing a passivating chemical.
- H. Air-cool products which may be prone to distortion to avoid the effects of thermal shock.
- I. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

3.03 COATING REQUIREMENTS

- A. Coating Weight: Conform with paragraph 5.1 of ASTM A 123, Table 1 of ASTM A 767, or Table 1 of ASTM A 153, as appropriate.
- B. Surface Finish: Continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article.
- C. Adhesion: Withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

3.04 WELDING

- A. Perform welding of galvanized steel in accordance with the American Welding Society publication D19.0-72, Welding Zinc Coated Steel.

3.05 REPAIR OF DAMAGED COATING

- A. The maximum area to be repaired is defined in accordance with ASTM A 123 Section 6.2 current edition.
 1. The maximum area allowed to be repaired in the field shall be determined in advance and prior to the start of fabrication by mutual agreement between the galvanizer, steel fabricator, Architect, and Owner.
- B. Surfaces to be repaired shall be clean, dry, and free of oil, grease and corrosion products.
- C. Repair uncoated areas and areas damaged by welding, flame cutting or during handling, transport or erection by one of the following methods in accordance with ASTM A 780 whenever

damage exceeds 3/16 inch in dimension. Minimum thickness requirements for the repair are described in ASTM A 123 section 6.2.3 current edition and in ASTM A 780.

1. Repair Using Zinc-Based Alloys: Comply with requirements in Annex A1 in ASTM A 780.
 2. Repair Using Paints Containing Zinc Dust: Comply with requirements in Annex A2 in ASTM A 780.
 - a. The use of aerosol (spray) cans is prohibited. Use brush applied paint products for touch up of galvanized surfaces.
 3. Repair Using Sprayed Zinc (Metallizing): Comply with requirements in Annex A3 in ASTM A 780.
- D. Wet Storage Stain: Remove wet storage stain as follows prior to installation to prevent premature failure of the coating:
1. Arrange objects to allow rapid surface drying.
 2. Remove light deposits with a stiff bristle (not wire) brush. Remove heavier deposits by brushing with an acidic based metal cleaner. Thoroughly rinse cleaned surfaces with water.
 3. Check coating thickness in affected areas to ensure that the zinc coating remaining after the removal of wet storage stain is sufficient to meet or exceed specified requirements.

END OF SECTION 05 05 13.13

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

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HAA Project Number: 2013088.22
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SECTION 05 31 00 - STEEL DECKING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Roof deck
 - 2. Deck for supported slab.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
 - 2. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 3. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
 - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. 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.
- D. Evaluation Reports: For steel deck.
- E. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 PRODUCTS

2.01 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Canam United States; Canam Group Inc.
 - 2. Epic Metals Corporation.

3. New Millennium Building Systems, LLC.
 4. Nucor Corp.; Vulcraft Group.
 5. Roof Deck, Inc.
 6. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
- B. 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, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 zinc coating.
 2. Deck Profile: Type B, wide rib
 3. Profile Depth: As specified on drawings.
 4. Design Uncoated-Steel Thickness: As specified on drawings.
 5. Span Condition: As indicated.
 6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.02 COMPOSITE FLOOR DECK

- A. 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, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
 2. Profile Depth: As specified on drawings.
 3. Design Uncoated-Steel Thickness: As specified on drawings
 4. Span Condition: As indicated.

2.03 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- I. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.
- J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 EXECUTION

3.01 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.

3.02 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.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.03 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches apart in the field of roof and 6 inches apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches.
- D. Miscellaneous Roof-Deck Accessories: Install 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.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.04 FLOOR-DECK INSTALLATION

- A. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- B. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.06 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Steel framing and supports for countertops and benches.
 - 2. Steel framing and supports for mechanical and electrical equipment.
 - 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 4. Shelf angles.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Loose steel lintels.
 - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Requirements:
 - 1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 - 2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 - 3. Division 05 Section "Steel Decking."

1.03 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Paint products.
 - 2. Grout.
- B. VOC Data:
 - 1. Laboratory Test Reports for Credit IEQ 4.2: For primers, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Small-Scale Environmental Chambers."
- C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - 1. Steel framing and supports for countertops.
 - 2. Steel framing and supports for mechanical and electrical equipment.
 - 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.

4. Shelf angles.
5. Loose steel lintels.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.06 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.07 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: 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. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.03 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 1. Provide stainless-steel fasteners for fastening aluminum.
 2. Provide stainless-steel fasteners for fastening stainless steel.
 3. Provide stainless-steel fasteners for fastening nickel silver.
 4. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1 (A1).
- E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.04 MISCELLANEOUS MATERIALS

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.05 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. 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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
1. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.07 SHELF ANGLES

- A. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

2.08 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in interior walls with primer specified in Division 09 Section "Interior Painting."

2.09 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Division 09 Section "Interior Painting" unless zinc-rich primer is indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Division 09 Section "Interior Painting": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. 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.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.03 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 Section "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 50 00

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Steel tube railings.

1.03 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.05 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.

1.06 METALS, GENERAL

- A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1.07 STEEL AND IRON

- A. Tubing: ASTM A 513.
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.

1.08 FASTENERS

- A. General: Provide the following:
 - 1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
- B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy [Group 1 (A1)] [Group 2 (A4)] stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

1.09 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

1.10 FABRICATION

- A. 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.
- B. Form work true to line and level with accurate angles and surfaces.
- C. 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.
 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 flux immediately.
 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- D. For changes in direction made by bending, use 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.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
 2. STEEL AND IRON FINISHES
- G. Galvanized Railings:
 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
- H. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

- I. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 2 EXECUTION

2.01 INSTALLATION, GENERAL

- A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

2.02 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members.

2.03 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 52 13

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Wood blocking and nailers.
 - 3. Plywood backing panels.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
- B. VOC Data:
 - 1. Laboratory Test Reports for plywood, documentation indicating that product complies 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."

1.04 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Power-driven fasteners.

PART 2 PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

- A. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal thickness or less, no limit for more than 2-inch nominal thickness unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 3. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- C. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Concealed blocking.
 - 2. Plywood backing panels.

2.04 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
- B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber of any species.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine, No. 3 grade; SPIB.
 - 2. Eastern softwoods, No. 3 Common grade; NELMA.
 - 3. Northern species, No. 3 Common grade; NLGA.
 - 4. Western woods, Standard or No. 3 Common grade; WCLIB or WWPA.

2.05 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.
 - 1. Plywood 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."

2.06 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Power-Driven Fasteners: NES NER-272.

- C. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

2.07 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Self-adhesive butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit.
- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.02 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 06 20 23 - INTERIOR FINISH CARPENTRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Interior trim.
- B. Related Requirements:
 - 1. Division 06 Section "Solid Surface Fabrications"

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
- B. VOC Data:
 - 1. Product Data: For adhesives and glues used at Project site, documentation including printed statement of VOC content.
 - 2. Product Data: For composite wood products, documentation indicating that product contains no urea formaldehyde.
 - 3. Laboratory Test Reports for adhesives, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 4. Laboratory Test Reports for composite wood products, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Samples: For each type of wood to receive transparent finish.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

- A. Low-Emitting Materials: Composite wood products shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Lumber: DOC PS 20.
 - 1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
 - 2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.
- C. Softwood Plywood: DOC PS 1.
- D. Hardboard: AHA A135.4.
- E. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.
- F. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea-formaldehyde resin.
- G. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.02 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent respectively.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. For exposed lumber and plywood indicated to receive a stained or natural finish, mark back of each piece.
- C. Application: Where indicated.

2.03 INTERIOR TRIM

- A. Softwood Lumber Trim:
 - 1. Species and Grade: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; Premium or 2 Common (Sterling); NeLMA, NLGA, or WWPA.
 - 2. Species and Grade: Douglas fir-larch or Douglas fir south, Prime or D finish; NLGA, WCLIB, or WWPA.
 - 3. Maximum Moisture Content: 15 percent.
- B. Hardwood Lumber Trim:
 - 1. Species and Grade: Aspen, basswood, cottonwood, sap gum, sycamore, white maple, or yellow poplar; Clear A Finish; NHLA.
 - 2. Maximum Moisture Content: 10 percent.

2.04 MISCELLANEOUS MATERIALS

- A. Low-Emitting Materials: Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
 - 1. Wood glue shall have a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 EXECUTION

3.01 PREPARATION

- A. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.02 INSTALLATION, GENERAL

- A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

3.03 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints.

END OF SECTION 06 20 23

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 06 61 16 - SOLID SURFACE FABRICATIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 RELATED SECTIONS

- A. Division 06 Section "Miscellaneous Rough Carpentry."
- B. Division 06 Section "Interior Finish Carpentry"
- C. Division 12 Section "Manufactured Wood Casework"

1.03 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
 - 3. ASTM G 22 - Standard Practice for Determining Resistance of Plastics to Bacteria.
- B. National Fire Protection Association: NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- C. Underwriters Laboratories: UL 723 - Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

- A. Submit under provisions of Division 01 Section "Submittal Procedures."
- B. Product Data: Manufacturer's complete and current product data for each product required, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Complete installation methods.
- C. Shop Drawings: Show locations of each item and installation details. Provide plan, section and elevation drawings conditions as necessary to depict correct installation procedures.
- D. Verification Samples: For each product type specified, two samples, minimum of 3 inches square representing product configurations specified herein.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Primary products specified in this section will be provided by a single manufacturer with a minimum of ten years experience.
- B. Installer Qualifications: Products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
- C. Provide test reports showing compliance with the performance specified for:
 - 1. Fire-related properties.
 - 2. Accessibility and safety properties.
 - 3. Impact strength.
 - 4. Coefficient of friction.

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 PROJECT CONDITIONS

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

1.08 WARRANTY

- A. Manufacturer's Standard Warranty: At project closeout, provide to Owner or Owners representative an executed copy of the manufacturer's limited warranty against manufacturing defect outlining its terms, conditions and exclusions from coverage.
 - 1. Warranty Period: Ten years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in finish schedule or comparable product approved by architect by one of the following:
 - 1. Formica
 - 2. Surrell
 - 3. Nevamar
 - 4. Fountainhead
 - 5. Corian
 - 6. Wilsonart
 - 7. Gibraltar

2.02 PERFORMANCE REQUIREMENTS

- A. Materials:
 - 1. Compliance: Provide solid surface material that conforms to ANSI/ICPA SS-1 for workmanship and finish, structural integrity and material characteristics.
 - 2. Composition: Homogenous solid sheets of filled plastic resin.
- B. Fungal and Bacterial Resistance: Provide solid surface that does not support fungal and bacterial growth as tested in accordance with ASTM G 21 and ASTM G 22.
- C. Workmanship and Finish, Structural Integrity and Material Characteristics: Provide solid surface material that conforms to ANSI/ICPA SS-1.

2.03 COUNTERTOPS

- A. Countertops:
 - 1. Fabricated to size and shape for locations as specified on the Architect's Drawings.
 - 2. Seams shall be adhesively joined and inconspicuous.
 - 3. Thickness: 3/4 inch.

2.04 WINDOW SILLS

- A. Solid Surface Window Sills:
 - 1. Fabricated to size and shape for locations as specified on the Architect's Drawings.
 - 2. Seams shall be adhesively joined and inconspicuous.
 - 3. Window Sill Thickness: 3/4 inch.
- B. Window Sill Accessories:
 - 1. Solid Surface Bonding Adhesive: 9.8 ounce.
 - 2. Adhesive Cartridge Dispenser.
 - 3. Adhesive Mixing Tips.
 - 4. Silicone Sealant.

2.05 FINISHES

- A. Colors: Provide surfaces in colors as follows:
 - 1. As noted on the Finish Schedule of the Contract Drawings.

2.06 ACCESSORIES

- A. Provide appropriate fasteners and accessories as required to properly complete installation.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

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

3.04 PROTECTION

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

3.05 ADJUSTING AND CLEANING

- A. Verify that surfaces are level, plumb and rigidly secured to substrate; make any adjustments required.
- B. Clean finished surfaces and immediate areas of installation, using materials and methods recommended by manufacturer. Remove from project site packaging and debris caused by installation.

END OF SECTION 06 61 16

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 07 01 51.71 - ROOF REPAIRS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Repairs and patching of existing roof system.
- B. Related Sections include the following:
 - 1. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking, curbs, cants, and nailers; and wood-based, structural-use roof deck panels.
 - 2. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
 - 3. Division 07 Section "Joint Sealants."
 - 4. Facility Services Subgroup Sections for roof drains.

1.03 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. Existing Membrane Roofing System: Built-up asphalt or coal-tar roofing membrane, roof insulation, surfacing, and components and accessories between deck and roofing membrane.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.05 INFORMATIONAL SUBMITTALS

- A. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform Work of this Section who has specialized in installing roofing similar to that required for this Project; who is approved, authorized, or licensed by the roofing system manufacturer to perform the repair work as required to maintain any existing roof warranties.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning membrane roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Roofing Repair Conference: Conduct conference at Project site.
 - 1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing system manufacturer's representative; deck Installer; roofing Installer including project manager, superintendent, and foreman; and installers whose work interfaces with or affects reroofing including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing scope, but not limited to, the following:
 - a. Roofing repair preparation, including membrane roofing system manufacturer's written instructions.
 - b. Temporary protection requirements for existing roofing system that is to remain during and after installation.
 - c. Existing roof drains and roof drainage during each stage of reroofing, and roof drain plugging and plug removal requirements.

- d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- e. Existing deck removal procedures and Owner notifications.
- f. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
- g. Structural loading limitations of deck during reroofing.
- h. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect reroofing.
- i. HVAC shutdown and sealing of air intakes.
- j. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
- k. Governing regulations and requirements for insurance and certificates if applicable.
- l. Existing conditions that may require notification of Architect before proceeding.

1.07 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner's operations will not be disrupted. Provide Owner with not less than seven days notice of activities that may affect Owner's operations.
 - 1. Coordinate work activities daily with Owner so Owner can place protective dust or water leakage covers over sensitive equipment or furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below the work area.
 - 2. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below the affected area. Verify that occupants below the work area have been evacuated before proceeding with work over the impaired deck area.
- B. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- D. Coordinate roof repair work with mechanical and electrical and other work requiring roof penetrations and subsequent repairs.
- E. Schedule work to coincide with commencement of installation of new rooftop equipment.
- F. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
- G. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
- H. Remove no more existing roofing materials than can be replaced with new materials the same day.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials according to roofing system manufacturer's written instructions. Store rolls of felt and other sheet materials on end on pallets or other raised surfaces. Do not double-stack rolls.
 - 1. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.
- B. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather and moisture and unless maintained at a temperature exceeding 50 deg F.
- C. Deliver and store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
- D. Protect roofing insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

1.09 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during reroofing, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.
 - 1. Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General: Provide a watertight, roofing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and continued exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

2.02 MATERIALS

- A. Temporary Protection: Sheet polyethylene or fiber reinforced plastic sheeting. Provide weights to retain sheeting in position.
- B. Patching and Repair Materials: Match existing roofing system materials unless otherwise indicated.
- C. Auxiliary Materials: Reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing roofing system.
- D. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.
- B. Verify that roof openings and penetrations are in place and set and braced.
- C. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at roof penetrations and terminations and match the thicknesses of insulation required.

3.02 PREPARATION

- A. Protect existing roofing system that is indicated not to be reroofed.
 - 1. Loosely lay 1-inch-minimum thick, molded expanded polystyrene (MEPS) insulation over the roofing membrane in areas indicated. Loosely lay 15/32-inch plywood or OSB panels over MEPS. Extend MEPS past edges of plywood or OSB panels a minimum of 1 inch.
 - 2. Limit traffic and material storage to areas of existing roofing membrane that have been protected.
 - 3. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
- B. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
- C. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- D. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs

specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

1. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new membrane roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing membrane roofing system components that are to remain.
- E. Verify that rooftop utilities and service piping have been shut off before beginning the Work.
- F. Clean roof surface of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- G. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.03 REMOVAL OF EXISTING ROOFING

- A. General: Notify Owner each day of extent of roof tear-off proposed for that day.
- B. Remove existing base flashings around parapets, curbs, walls, and penetrations.
 1. Clean substrates of contaminants such as asphalt, sheet materials, dirt, and debris.
- C. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings of same metal, weight or thickness, and finish.
- D. Inspect parapet sheathing for deterioration and damage. If parapet sheathing has deteriorated, immediately notify Architect.
- E. Remove existing roofing as required to provide access for new deck penetrations. Remove aggregate surfacing, membranes, flashings, insulation, vapor retarders, and any other roof elements to expose structural deck.
- F. Inspect and repair existing deck surface to provide smooth working surface for replacement roof system.
- G. Provide temporary protective sheeting over exposed deck surfaces.
- H. Turn protective sheeting up and over parapets and curbing. Retain sheeting in position with weights or temporary fasteners.
- I. Provide for surface drainage from sheeting to existing drainage facilities.

3.04 GENERAL INSTALLATION REQUIREMENTS

- A. Patch roofing system according to roofing system manufacturer's written instructions and applicable recommendations of NRCA quality control guidelines applicable to the type of roofing encountered.
- B. Immediately after removal of selected portions of existing membrane roofing system, and inspection and repair, if needed, of deck, fill in the tear-off areas to match existing membrane roofing system construction.
 1. Install new roofing membrane the same day tear-off is made.

3.05 DISPOSAL

- A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
 1. Storage or sale of demolished items or materials on-site is not permitted.
- B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 07 01 51.71

SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber blanket insulation.
 - 2. Polyiso rigid insulation.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.04 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research/evaluation reports.

PART 2 PRODUCTS

2.01 GLASS-FIBER BLANKET INSULATION

- 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. Guardian Building Products, Inc.
 - 2. Johns Manville.
 - 3. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
 - 1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 - 2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.02 FOAM-PLASTIC BOARD INSULATION

- A. Foil-Faced, Polyisocyanurate Board Insulation (Type 1): ASTM C 1289, Type I, Class 1, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84. Tested per NFPA 285 in wall assembly as drawn.
 - 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. Atlas Roofing Corporation.
 - b. Firestone Building Products Co.
 - c. Dow Chemical Company (The).

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.02 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

END OF SECTION 07 21 00

SECTION 07 21 29 - SPRAY-ON INSULATION SYSTEM

PART 1 - GENERAL

1.01 1.01 SECTION INCLUDES

- A. Sprayed cellulose acoustical insulation.

1.02 RELATED ITEMS

- A. Clips, hangers, supports, sleeves and other attachments to spray bases are to be placed by other trades prior to the application of sprayed insulation.
- B. Ducts, piping, conduit or other suspended equipment shall not be positioned until after the application of sprayed insulation.
- C. Roof penetrations to be installed prior to application.

1.03 1.03 QUALITY ASSURANCE

- A. Manufacturer must have a current Underwriters Laboratories (UL) Code Evaluation Report.
- B. Manufacturer must be in compliance with the 2009 and 2012 International Building Code.
- C. Manufacturer must be ISO 9001:2015 Certified.
- D. Applicator: Licensed by manufacturer.
- E. Manufacturer must subscribe to independent laboratory follow-up inspection services of Underwriters Laboratories and Factory Mutual. Each bag shall be labeled accordingly.
- F. Mock-up: Apply a 100 square foot representative sample to be reviewed by the Architect and/or Owner prior to proceeding.

1.04 1.04 SUBMITTALS

- A. Submit product data that the product meets or exceeds the following specified requirements.
 - 1. Bond strength shall be greater than 100 psf per ASTM E 736.
 - 2. Product shall be Class 1 Class A per ASTM E 84/ UL 723.
 - 3. Non-corrosive per ASTM C 739.
 - 4. Bond Deflection per ASTM E 759: 6" Deflection in 10' Span - No Spalling or Delamination.
 - 5. R-Value to be 3.75 per inch per ASTM C 518.
 - 6. Comply with 2009 IBC Section 803.10 stability requirements for interior finishes.
 - 7. Meet ASTM C 1149
 - a. Manufacturer's written certification that product contains no asbestos, fiberglass or other man-made mineral fibers.
 - b. Copy of manufacturer's ISO 9001:2015 Certification.
 - c. Minimum Fiber Recycled Content to be 75%.
 - d. Cannot contain any added Urea-Formaldehyde Resins.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver in original, unopened containers bearing name of manufacturer, product identification and reference to U.L. testing.
- B. Store materials dry, off ground, and under cover.
- C. Protect liquid adhesive from freezing.
- D. Water to be potable.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. International Cellulose Corporation
- B. 12315 Robin Boulevard
- C. Houston, Texas 77045

- D. (713) 433-6701 or (800) 444-1252
- E. FAX: (713) 433-2029
- F. www.spray-on.com icc@spray-on.com
- G. For approved applicators contact ICC at 800-444-1252.

2.02 MATERIALS

- A. K-13 Spray-On-Systems.
 - 1. Color shall be from Manufacturer's standard color chart.
 - 2. Comply with local Building Code requirements.
 - 3. Material to have been tested in accordance with ASTM E 1042. Testing laboratory must be NVLAP accredited.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces and report unsatisfactory conditions in writing. Do not proceed until unsatisfactory conditions are corrected.
- B. Verify surfaces to receive spray insulation to determine if priming/sealing is required to insure bonding and/or to prevent discoloration caused by migratory stains.

3.02 PREPARATION

- A. Provide masking, drop cloths or other satisfactory coverings for materials/surfaces that are not to receive insulation to protect from over-spray.
- B. Coordinate installation of the sprayed cellulose fiber with work of other trades.
- C. Prime surfaces as required by manufacturer's instructions or as determined by examination.

3.03 INSTALLATION

- A. Install spray applied insulation according to manufacturer's recommendations.
- B. Install spray applied insulation to achieve an average nominal NRC of 1.00 using 1.75" spray thickness.

K-13 SPRAYED THERMAL AND ACOUSTICAL INSULATION ASTM C-423 ON SOLID BACKING							
INCHES	125 HZ	250 HZ	500 HZ	1000 HZ	2000 HZ	4000 HZ	NRC
1"	0.11	0.32	0.84	0.99	1.01	0.98	0.80
1.75"	0.30	0.74	1.14	1.06	0.99	0.98	1.00
2"	0.47	0.90	1.06	1.06	1.08	1.07	1.00
3"	0.57	0.99	1.04	1.03	1.00	0.98	1.00
4"	0.84	1.06	1.01	1.03	1.00	0.98	1.05
5"	0.99	0.89	1.05	1.03	1.00	1.00	1.00

K-13 SPRAYED THERMAL AND ACOUSTICAL INSULATION APPLIED ON 1.5" METAL DECK							
INCHES	125 HZ	250 HZ	500 HZ	1000 HZ	2000 HZ	4000 HZ	NRC
1.50	0.36	0.89	1.26	1.07	1.01	1.00	1.05
3.00	0.97	1.04	1.13	0.99	0.95	0.98	1.05

- A. Cure insulation with continuous natural or mechanical ventilation.
- B. Remove and dispose of over-spray.

3.04 PROTECTION

- A. Protect finished installation under provision of Division 1.

END OF SECTION 07 21 29

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HAA Project Number: 2013088.22
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SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Manufactured reglets with counterflashing.
 - 2. Formed wall sheet metal fabrications.
 - 3. Equipment Support Flashing.
 - 4. Formed sheet metal roof curb caps.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Distinguish between shop- and field-assembled work.
 - 3. Include identification of finish for each item.
 - 4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.
- C. Samples: For each exposed product and for each color and texture specified.

1.04 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Product test reports.
- C. Sample warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.07 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

- 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; 2D (dull, cold rolled) finish.

2.03 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder:
 - 1. For Stainless Steel: ASTM B 32, Grade Sn96, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Sealant and Sealant Tape: Provide sealant and sealant tape compatible with adjacent materials and complying with requirements in Division 07 Section "Joint Sealants."
- E. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.04 MANUFACTURED REGLETS

- A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
 - 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. Cheney Flashing Company.
 - b. Fry Reglet Corporation.
 - c. Heckmann Building Products, Inc.
 - d. Hickman, W. P. Company.
 - e. Hohmann & Barnard, Inc.
 - f. Keystone Flashing Company, Inc.
 - g. National Sheet Metal Systems, Inc.
 - h. Sandell Manufacturing.
 - 2. Material: Stainless steel, 0.019 inch thick.
 - 3. Finish: Mill.

2.05 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing, caps and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Obtain field measurements for accurate fit before shop fabrication.
 - 2. Form sheet metal flashing, caps and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- C. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder; or
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.06 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.019 inch thick.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within of corner or intersection.
 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance, but in no case less than 1-1/4 inch for nails and not less than 3/4 inch for wood screws.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 1. Do not use torches for soldering.
 2. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 3. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.02 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.03 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04 Sections "Unit Masonry" .
- C. Opening Flashings: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.04 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 07 62 00

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
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SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Equipment supports.
 - 2. Pipe and duct supports.
 - 3. Pipe portals.
 - 4. Preformed flashing sleeves.
- B. Related Sections:
 - 1. Division 04 Section "Pipe and Tube Railings" for roof safety rails.
 - 2. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
 - 3. Division 23 Section "Air-To-Air Energy Recovery Units" for standard curbs specified with rooftop units.

1.03 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leak-proof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories.
 - 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.
- D. Delegated-Design Submittal: For equipment supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
 - 2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

4. Required clearances.

B. Sample Warranties: For manufacturer's special warranties.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.07 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design equipment supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Wind-Restraint Performance: As indicated on Drawings.

2.02 EQUIPMENT SUPPORTS

- A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed structure-mounting flange at bottom.
 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. AES Industries, Inc.
 - b. Custom Solution Roof and Metal Products.
 - c. LM Curbs.
 - d. Roof Curb Systems Inc.
 - e. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
 - f. Roof Products, Inc.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: As indicated on drawings.
- D. Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet, 0.079 inch thick.
 1. Finish: Mill phosphatized.
 2. Color: As selected by Architect from manufacturer's full range.
- E. Material: Stainless-steel sheet, 0.078 inch thick.
 1. Finish: Manufacturer's standard.

F. Construction:

1. Curb Profile: Profile as indicated on Drawings, where not indicated use manufacturer's standard profile compatible with roofing system.
2. Insulation: Factory insulated with 1-1/2-inch-thick glass-fiber board insulation.
3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
4. Nailer: Factory-installed continuous wood nailers on top flange of equipment supports, continuous around support perimeter.
5. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
8. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
9. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.
10. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.03 PIPE SUPPORTS

- A. Fixed-Height Cradle-Type Pipe Supports: Polycarbonate pipe stand accommodating up to 1-1/2-inch- diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.
- B. Adjustable-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand base, pipe support, and roller housing, with stainless-steel threaded rod designed for adjusting support height, accommodating up to 18 inch diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

2.04 PIPE PORTALS

- A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless-steel snaplock swivel clamps.
 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. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc
 - b. Portals Plus
- B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless-steel snaplock swivel clamps.
 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. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc

- b. Portals Plus

2.05 PREFORMED FLASHING SLEEVES

- A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.
 - 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. Custom Solution Roof and Metal Products.
 - b. Thaler Metal Industries Ltd.
 - 2. Metal: Aluminum sheet, 0.063 inch thick.
 - 3. Diameter: As indicated on Drawings
 - 4. Finish: Manufacturer's standard.
- B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.
 - 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. Custom Solution Roof and Metal Products.
 - b. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - c. Thaler Metal Industries Ltd.
 - 2. Metal: Aluminum sheet, 0.063 inch thick.
 - 3. Height: 13 inches.
 - 4. Diameter: As indicated on Drawings
 - 5. Finish: Manufacturer's standard.

2.06 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation and mill phosphatized for field painting where indicated.
 - 1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.
 - 1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Mill Finish: As manufactured.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- D. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.
- E. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.
- F. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.
- G. Steel Tube: ASTM A 500/A 500M, round tube.

- H. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- I. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.07 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPAC2; not less than 1-1/2 inches thick.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Underlayment:
 - 1. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 2. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.
 - 3. Slip Sheet: Building paper, 3 lb/100 sq. ft. minimum, rosin sized.
 - 4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 5. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 6. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
 - 7. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 8. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- I. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required for application.

2.08 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum and stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- D. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
 - 1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- E. Preformed Flashing-Sleeve and Flashing Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.
- F. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.03 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.
- B. Touch up factory-primed surfaces with comparable exterior primer ready for field painting.
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

SECTION 07 84 00 - FIRESTOPPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes through-penetration and fire-resistive joint system materials and systems installed in cavities, around penetrations, and openings in floors, walls, partitions, and other building components to prevent spread of fire and smoke.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Schedule: For each firestopping system. Include locations and design designation of qualified testing and inspecting agency.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular firestopping condition, or where there is no specific third party tested and classified firestop system available for particular firestop condition, submit illustration, with modifications marked, approved by firestopping manufacturer's fire-protection engineer as an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA).
 - 2. Format: Per attached "Firestopping Schedule."
- B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product test reports.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.
- B. Fire-Test-Response Characteristics: Firestopping shall comply with the following requirements:
 - 1. Firestop system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" and "Fire-Resistant Joint Systems" Articles. Provide rated systems complying with the following requirements:
- C. Preinstallation Conference: Conduct conference at Project site .

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M Fire Protection Products.
 - 2. A/D Fire Protection Systems Inc.
 - 3. Grace Construction Products.
 - 4. Hilti, Inc.
 - 5. Johns Manville.
 - 6. Nelson Firestop Products.
 - 7. NUCO Inc.
 - 8. Passive Fire Protection Partners.

9. RectorSeal Corporation.
10. Specified Technologies Inc.
11. Tremco, Inc.; Tremco Fire Protection Systems Group.
12. USG Corporation.

2.02 FIRESTOPPING, GENERAL

- A. Systems listed by approved testing agencies, as identified in Part 1 above, may be used, providing they conform to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance.
- B. Provide firestopping systems that are produced and installed to resist the spread of fire, and the passage of smoke and other gases according to requirements indicated, and maintain original fire-resistance rating of construction penetrated and in or between which fire-resistant joint systems are installed. Firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any. Fire-resistant joint systems shall accommodate building movements without impairing their ability to resist the passage of fire, smoke, and hot gases.
- C. Exposed Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- D. For firestopping exposed to view, traffic, moisture, and physical damage, provide firestop systems appropriate for these conditions.
- E. VOC Content: Provide firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.

2.03 PENETRATION FIRESTOPPING

- A. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- B. Penetrations in Horizontal Assemblies: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations located within the cavity of a wall or shaft enclosure.
- C. Penetrations in Smoke Barriers: Ratings determined per UL 1479.
 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

2.04 FIRE-RESISTANT JOINT SYSTEMS

- A. Joints in or between Fire-Resistance-Rated Construction: Ratings determined per ASTM E 1966 or UL 2079:
 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
- B. Joints in Smoke Barriers: Ratings determined per UL 2079.
 1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.

2.05 ACCESSORIES

- A. Accessories: Provide components for each firestop system, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by firestop system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening or joint configurations, penetrating items, substrates, and other conditions affecting performance of firestopping.
- B. Install firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
 - 1. Coordinate with other trades to assure that all pipes, conduit, cable, and other items, which penetrate fire rated construction, are complete and have been permanently installed prior to installation of firestop assemblies.
 - 2. Schedule the work to assure that partitions and all other construction that conceal penetrations are not erected prior to the installation of firestop and smoke seals.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- D. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.02 IDENTIFICATION

- A. Identify firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Fire-Resistant Joint System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.03 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 07 84 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke resistant walls.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. VOC Data:
 - 1. Product Data for Credit IEQ 4.1: For penetration firestopping sealants and sealant primers, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit IEQ 4: For penetration firestopping sealants and sealant 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. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.04 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- B. Product test reports.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by UL, Intertek ETL SEMKO, or FM Global.
 - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems bearing marking of qualified testing and inspection agency.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. A/D Fire Protection Systems Inc.
 - 2. Grace Construction Products.

3. Hilti, Inc.
4. Johns Manville.
5. Nelson Firestop Products.
6. NUCO Inc.
7. Passive Fire Protection Partners.
8. RectorSeal Corporation.
9. Specified Technologies Inc.
10. 3M Fire Protection Products.
11. Tremco, Inc.; Tremco Fire Protection Systems Group.
12. USG Corporation.

2.02 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Resistant walls: Provide penetration firestopping with ratings determined per UL 1479.
 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Low-Emitting Materials: Penetration firestopping sealants and sealant primers 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."
- H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- D. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.02 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.03 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.04 PENETRATION FIRESTOPPING SCHEDULE

- A. Provide penetration firestopping as indicated in drawings.
- B. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

END OF SECTION 07 84 13

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Nonstaining silicone joint sealants.
 - 3. Urethane joint sealants.
 - 4. Immersible joint sealants.
 - 5. Silyl-terminated polyether joint sealants.
 - 6. Mildew-resistant joint sealants.
 - 7. Polysulfide joint sealants.
 - 8. Butyl joint sealants.
 - 9. Latex joint sealants.
 - 10. Acoustical joint sealants
- B. Related Requirements:
 - 1. Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. VOC Data:
 - 1. Product Data for sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for sealants and sealant primers used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- C. Field-Adhesion-Test Reports: For each sealant application tested.
- D. Sample Warranties: For special warranties.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.07 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
- B. If ambient and substrate temperature conditions are expected to be below 40 deg F., the contractor shall provide an alternate joint-sealant manufacturer and product that are appropriately rated for the conditions and scope of work to be completed.

1.08 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.01 JOINT SEALANTS, GENERAL

- A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- C. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
 1. Architectural sealants shall have a VOC content of 250 g/L or less.
 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.

3. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.
- D. Low-Emitting Interior Sealants: Sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Colors of Exposed Joint Sealants: To match color of adjacent surface, or as selected by Architect from manufacturer's full range.
- F. Type:
 1. Provide Type M (multicomponent) sealants where required to achieve color match indicated and where specifically indicated.
 2. Provide Type S (single component) or Type M (multicomponent) sealants elsewhere.
- G. Grade:
 1. Provide Grade P (pourable) or Grade NS (nonsag) sealants at horizontal joints.
 2. Provide Grade NS (nonsag) sealants at vertical and non-horizontal joints.
- H. Class: Provide sealants suitable for anticipated joint movement.
- I. Use Related to Exposure:
 1. Provide Use T (traffic) at horizontal traffic surfaces.
 2. Provide Use NT (nontraffic) or T (traffic) at vertical and horizontal non-traffic surfaces.
 3. Provide sealants suitable for contact with food where sealants are indicated for joints that will come in repeated contact with food.
 4. Where sealants are indicated for joints that are scheduled to be painted, provide sealants that accept paint coatings over cured sealant with no adverse affects to the applied paint including but not limited to staining, discoloration, and adhesion failure.
- J. Uses Related to Joint Substrates: Provide sealants suitable for contact with joint substrates indicated including but not limited to Mortar (M), Glass (G), Aluminum (A), and Other (O) as applicable.
 1. Use O Joint Substrates: Coated glass, Color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick, granite, limestone, marble, ceramic tile, wood, and other Use O substrates as indicated.
 2. Do not use acid-curing silicone sealants for the following joint substrates: Galvanized steel, marble, cement-based materials, copper, and other materials and finishes which may be corroded by acid-curing silicone sealant formulations.
 3. Do not use silicone sealants for applications where they will be continuously immersed in liquids.
 4. For fire-resistive glazing, use products identical to products used in test assemblies to obtain fire-protection rating.
- K. Joint Width: Provide sealants suitable for joint openings based on manufacturer's published minimum and maximum joint widths and depths.

2.02 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants (All Silicone, Urethane, Polysulfide and Silyl-terminated polyether sealants): Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to

ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

- D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.
- F. Where elastomeric sealants are indicated for joints that are scheduled to be painted, provide products that accept paint coatings over cured sealant with no adverse affects to the applied paint including but not limited to staining, discoloration, and adhesion failure.
- G. Refer to separate Joint Sealant Products Schedule for a list of acceptable elastomeric sealant products.

2.03 SOLVENT-RELEASE JOINT SEALANTS

- A. Acrylic-Based Solvent-Release Joint Sealant: Comply with ASTM C 1311 or FS TT-S-00230.
- B. Butyl-Rubber-Based Solvent-Release Joint Sealant: Comply with ASTM C 1085.
- C. Refer to separate Joint Sealant Products Schedule for a list of acceptable solvent release sealant products.

2.04 LATEX JOINT SEALANTS

- A. Latex Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834, Type OP, Grade NF.
- B. Refer to separate Joint Sealant Products Schedule for a list of acceptable latex sealant products.

2.05 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
- C. Refer to separate Joint Sealant Products Schedule for a list of acceptable acoustical sealant products.

2.06 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 - 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. BASF Construction Chemicals, LLC, Building Systems.
 - b. Construction Foam Products, a division of Nomaco, Inc.
- B. Cylindrical Sealant Backings: ASTM C 1330, any of the following types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C (closed-cell material with a surface skin).
 - 2. Type B (bicellular material with a surface skin).

- C. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- D. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- E. Bond-Breaker Tape: Polyethylene tape or other plastic tape 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.

2.07 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.

- c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
- H. Installation of Glazing Sealants: Comply with manufacturer's written instructions and requirements specified in Division 08 Section "Glazing."

3.04 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Existing Sealant Joints: Perform not less than one test for each type of existing elastomeric sealant and joint substrate. Perform additional tests where damage is apparent to verify degree of adhesion or lack thereof.

- b. New Sealant Joints: Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - c. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab; Method B, Exposed Surface Finish Hand Pull Tab; or Method C, Field-Applied Sealant Joint Hand Pull Flap in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
 4. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.06 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
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SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Standard and custom hollow metal doors and frames.
 - 2. Steel sidelight, borrowed lite and transom frames.
 - 3. Louvers installed in hollow metal doors.
 - 4. Light frames and glazing installed in hollow metal doors.
- B. Related Sections:
 - 1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
 - 4. Division 08 Section "Door Hardware".
 - 5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 - 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
 - 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 - 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
 - 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
 - 10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
 - 11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
 - 12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
 - 13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
 - 14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
 - 15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
 - 16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of anchorages, joints, field splices, and connections.
 - 6. Details of accessories.
 - 7. Details of moldings, removable stops, and glazing.
 - 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 - 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 - 1. 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. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. 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.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).
 - 3. Steelcraft (S).

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.03 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.

- a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

2.04 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet for door openings up to 48 inches in width.
 3. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet for door openings greater than 48 inches in width.
 4. Manufacturers Basis of Design:
 - a. Curries Company (CU) - CM Series.
 - b. Curries Company (CU) - M Series.
- C. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

- A. Jamb Anchors:
 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.06 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.07 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.08 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
- D. Hollow Metal Frames:
 - 1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
 - 3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 - 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 - 6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
 - 7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.

8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 and 28 Sections.

2.09 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 08 11 13

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements:
 - 1. Division 08 Section "Glazing" for glass view panels in flush wood doors.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of door.
- B. VOC Data:
 - 1. Product Data for adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
 - 2. Laboratory Test Reports for adhesives, 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."
 - 3. Laboratory Test Reports for paints and coatings, 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."
 - 4. Laboratory Test Reports for composite wood products, 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: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
 - 7. Fire-protection ratings for fire-rated doors.
- D. Samples: For factory-finished doors.

1.04 INFORMATIONAL SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.

- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, 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.
- B. Doors are to be secured on site within the building prior to installation.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.
 - 4. Warranty Period for Hollow-Core Interior Doors: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Algoma Hardwoods, Inc.
 - 2. Eggers Industries.
 - 3. General Veneer Manufacturing Co.
 - 4. Graham Wood Doors; an Assa Abloy Group company.
 - 5. Marshfield Door Systems, Inc.
 - 6. Mohawk Doors; a Masonite company.

2.02 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
 - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
- B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- C. WDMA I.S.1-A Performance Grade:
 - 1. Heavy Duty unless otherwise indicated.
 - 2. Extra Heavy Duty: public toilets, janitor's closets, assembly spaces, exits, and entries.
 - 3. Standard Duty: Closets (not including janitor's closets).
- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - 2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

3. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- E. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- F. Particleboard-Core Doors:
 1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2, made with binder containing no urea-formaldehyde.
 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

2.03 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
 1. Grade: Premium, with Grade AA faces.
 2. Species: Species to match benches specified in division 6
 3. Cut: Match existing.
 4. Match between Veneer Leaves: Book match.
 5. Assembly of Veneer Leaves on Door Faces: Balance match.
 6. Pair and Set Match: Provide for doors hung in same opening.
 7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) or more.
 8. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
 9. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
 10. Core: Particleboard.
 11. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.
 12. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.04 LIGHT FRAMES

- A. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
- B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated.

2.05 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
- C. Openings: Factory cut and trim openings through doors.
 1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."

2.06 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors that are indicated to receive transparent finish.
- C. Use only paints and coatings that 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. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: WDMA TR-6 catalyzed polyurethane.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION 08 14 16

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames for walls and ceilings.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material.
- D. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 tested according to the following test method:
 - 1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 - 2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.02 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 - 2. Karp Associates, Inc.
 - 3. Milcor Inc.
 - 4. Potter Roemer
- B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- C. Flush Access Doors with Exposed Flanges:
 - 1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 - 2. Locations: Wall and ceiling.
 - 3. Door Size: As indicated.
 - 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
 - a. Finish: Factory prime.
 - 5. Frame Material: Same material, thickness, and finish as door.
 - 6. Hinges: Manufacturer's standard.
 - 7. Hardware: Provide locks in areas accessible to the public. Provide latches in areas not accessible to the public, unless otherwise indicated on Drawings.
- D. Fire-Rated, Flush Access Doors with Exposed Flanges:
 - 1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
 - 2. Locations: Wall and ceiling.
 - 3. Fire-Resistance Rating: Not less than that of adjacent construction.

4. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage.
 - a. Finish: Factory prime.
 5. Frame Material: Same material, thickness, and finish as door.
 6. Hinges: Manufacturer's standard.
 7. Hardware: Provide locks in areas accessible to the public. Provide latches in areas not accessible to the public, unless otherwise indicated on Drawings.
- E. Hardware:
1. Latch for Non-fire-Rated Units: Cam latch operated by spanner-head wrench.
 2. Latch for Fire-Rated Units: Slam latch operated by spanner-head wrench.
 3. Lock: Cylinder.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware."

2.03 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same type as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.04 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 1. For cylinder locks, furnish two keys per lock and key all locks alike.
- E. Size: Fabricate access door and frame assemblies to sizes indicated on Drawings or, if not indicated, to smallest size which allows free access to concealed work requiring access. Obtain Architect's approval for rectangular sizes.
 1. Nominal size 8 by 8 inch for access to controls etc. requiring one-handed operation within arm's length.
 2. Nominal size 12 by 12 inch for access to controls etc. requiring two-handed operation within arm's length.
 3. Where upper body access is required (such as above ceilings or beyond arm's length) provide nominal 18 by 18 inch size.
 4. Where full body access is required (such as entering a shaft) provide nominal 24 by 24 inch size.

2.05 FINISHES

- A. Steel and Metallic-Coated-Steel Finishes:
 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.
- C. All fasteners to back up construction to be concealed.

3.02 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 08 41 13 - ALUMINUM - FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish and install aluminum architectural storefront system complete with hardware and related components as shown on drawings and specified in this section.
- B. Basis of Design for exterior storefront and vent systems shall be EFCO 403 Thermal Flush-Glazed Shear Block Storefront with WV430 insert vents. Doors shall be wide stile and comparable to EFCO D500 entrances. Other approved manufacturers are as follows:
 - 1. Kawneer
 - 2. Capitol Aluminum and Glass
 - 3. Oldcastle Building Envelope
- C. Basis of Design for interior storefront systems shall be EFCO 402 Flush-Glazed Shear Block Storefront. Other approved manufacturers are as follows:
 - 1. Kawneer
 - 2. Capitol Aluminum and Glass
 - 3. Oldcastle Building Envelope
- D. Glass
 - 1. Reference Section 08 80 00 for Glass and Glazing.
 - 2. Reference Section 02 41 19 for Selective Demolition.
- E. Single Source Requirement
 - 1. All products listed in Section 1.02 shall be by the same manufacturer.

1.02 RELATED WORK

- A. Section 08 44 13 - Glazed Aluminum Curtain Walls
- B. Section 02 41 19 - Selective Demolition

1.03 LABORATORY TESTING AND PERFORMANCE REQUIREMENTS

- A. Aluminum Storefront
 - 1. Test Units
 - a. Air, water, and structural test unit size shall be a minimum of two lites high and three lites wide.
 - b. Thermal test unit sizes shall be 80" (2032 mm) wide x 80" (2032 mm) high with one intermediate vertical mullion and two lites of glass.
 - 2. Test Procedures and Performance
 - a. Air Infiltration Test
 - 1) Test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf (299 Pa).
 - 2) Air infiltration shall not exceed .06 cfm/SF (.30 l/s•m²) of unit.
 - b. Water Resistance Test
 - 1) Test unit in accordance with ASTM E 331.
 - 2) There shall be no uncontrolled water leakage at a static test pressure of 12.0 psf (575 Pa).
 - c. Uniform Load Deflection Test
 - 1) Test in accordance with ASTM E 330.
 - 2) Deflection under design load shall not exceed L/175 of the clear span.
 - d. Uniform Load Structural Test
 - 1) Test in accordance with ASTM E 330 at a pressure 1.5 times the design wind pressure in 1.05.B.3.b.
 - 2) At conclusion of the test, there shall be no glass breakage, permanent damage to fasteners, storefront parts, or any other damage that would cause the storefront to be defective.

- e. Condensation Resistance Test (CRF)
 - 1) Test unit in accordance with AAMA 1503.1.
 - 2) Condensation Resistance Factor (CRF) shall not be less than 56 (frame) when glazed with .29 center of glass U-Factor.
- f. Thermal Transmittance Test (Conductive U-Factor)
 - 1) With ventilators closed and locked, test unit in accordance with NFRC 100-2010.
 - 2) Conductive thermal transmittance (U-Factor) shall not be more than .41 BTU/hr•ft²•°F
 - 3) (2.33 W/m²•K) when glazed with .29 center of glass U-Factor.
- 3. Project Wind Loads based on Allowable Stress Design, ASCE 7-10
 - a. The system shall be designed to withstand the following loads normal to the plane of the wall:
 - 1) Positive pressure of 18 psf at non-corner zones.
 - 2) Negative pressure of 18 psf at non-corner zones.
 - 3) Negative pressure of 20 psf at corner zones.
- B. WV430 INSERT VENTS
 - 1. Test Units
 - a. Air, water, and structural test unit shall conform to requirements set forth in ANSI/AAMA/NWDA 101/I.S.2/NAFS-08 and manufacturer's standard locking/operating hardware and insulated glazing configuration.
 - 2. Test Procedures and Performances
 - a. Windows shall conform to all ANSI/AAMA/NWDA 101/I.S.2/NAFS-08 requirements for the window type referenced in 1.01.B. In addition, the following specific performance requirements shall be met.
 - b. Air Infiltration Test
 - 1) With ventilators closed and locked, test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf (299 Pa).
 - 2) Air infiltration shall not exceed .10 cfm/SF (.50 l/s•m²) of unit.
 - c. Water Resistance Test
 - 1) With ventilators closed and locked, test unit in accordance with ASTM E 331/ASTM E 547 at a static air pressure difference of 15.0 psf (720 Pa).
 - 2) There shall be no uncontrolled water leakage.
 - d. Uniform Load Structural Test
 - 1) With ventilators closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 90.0 psf (4309 Pa), both positive and negative.
 - 2) At conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, nor any other damage that would cause the window to be inoperable.
 - e. Condensation Resistance Test (CRF)
 - 1) Test unit in accordance with AAMA 1503.1.
 - 2) Condensation Resistance Factor (CRF) shall not be less than 66 (frame) when glazed with .29 center of glass U-Factor.
 - f. Thermal Transmittance Test (Conductive U-Factor)
 - 1) With ventilators closed and locked, test unit in accordance with NFRC 100-2010.
 - 2) Conductive thermal transmittance (U-Factor) shall not be more than .42 BTU/hr•ft²•°F
 - 3) when glazed with .29 center of glass U-Factor.
- C. Aluminum Entrances
 - 1. Test Units
 - a. Air test unit shall be minimum size of 36" (914 mm) x 84" (2134 mm).
 - 2. Test Procedures and Performances

- a. Entrance doors shall conform to all requirements for the door type referenced in 1.01.B. In addition, the following specific performance requirements shall be met.
- b. Air Infiltration Test
 - 1) With door sash closed and locked, test unit in accordance with ASTM E 283 at a static air pressure difference of 1.57 psf (75 Pa).
 - 2) Air infiltration shall not exceed .50 cfm/SF (2.54 l/s•m²) of unit, for single doors.

1.04 QUALITY ASSURANCE

- A. Provide test reports from AAMA accredited laboratories certifying the performance as specified in 1.05.
- B. Test reports shall be accompanied by the storefront manufacturer's letter of certification stating that the tested storefront meets or exceeds the referenced criteria for the appropriate storefront type.

1.05 SUBMITTALS

- A. Contractor shall submit shop drawings; finish samples, test reports, and warranties.
 - 1. Samples of materials as may be requested without cost to owner, i.e., metal, glass, fasteners, anchors, frame sections, mullion section, corner section, etc.
- B. An NFRC Bid Report document must be submitted upon request

1.06 WARRANTIES

- A. Total Storefront Installation
 - 1. The responsible contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total storefront installation. This includes the glass (including insulated units), glazing, anchorage and setting system, sealing, flashing, etc., as it relates to air, water and structural adequacy as called for in the specifications and approved shop drawings.
 - 2. Any deficiencies due to such elements not meeting the specifications shall be corrected by the responsible contractor at their expense during the warranty period.
- B. Window Material and Workmanship
 - 1. Provide written guarantee against defects in material and workmanship for 10 years from the date of final shipment.
- C. Glass
 - 1. Provide written warranty for insulated glass units that they will be free from obstruction of vision as a result of dust or film formation on the internal glass surfaces caused by failure of the hermetic seal due to defects in material and workmanship.
 - 2. Warranty period shall be for 10 (ten) years.
- D. Finish
 - 1. Warranty period shall be for 10 years from the date of final shipment.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aluminum
 - 1. Extruded aluminum shall be 6063-T6 alloy and temper.
- B. Glass
 - 1. Reference Section 08 80 00 for Glass and Glazing.
- C. Thermal Barrier
 - 1. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions.

2. Barrier material shall be poured-in-place, two-part polyurethane. A nonstructural thermal barrier is unacceptable.
- D. Hardware for 5" profile wide-stile entrance doors is specified under Section 087100 and 280000. The finish hardware supplier shall be responsible for furnishing physical hardware and templates of all hardware to the entrance door manufacturer prior to fabrication, and for coordinating hardware delivery requirements with the hardware manufacturer, the general contractor and the entrance door manufacturer to ensure the building project is not delayed.

2.02 FABRICATION

- A. General
 1. All aluminum frame extrusions shall have a minimum wall thickness of .080" (2 mm).
 2. All exposed work shall be carefully matched to produce continuity of line and design with all joints. System design shall be such that raw edges will not be visible at joints.
- B. Storefront Frame
 1. Depth of frame shall not be less than 4 1/2" (114 mm).
 2. Face dimension shall not be less than 2" (50 mm).
 3. Frame components shall be shear block construction.
- C. Storefront Glazing
 1. All units shall be "dry glazed" with gaskets on both exterior and interior of the glass.
- D. Entrance Doors
 1. Door stiles shall be no less than 5" (127 mm) wide (not including glass stops).
 2. Door stiles and rails shall have hairline joints at corners. Heavy concealed reinforcement brackets shall be secured with screws and shall be of deep penetration and fillet welded.
 3. Weather stripping shall be wool pile and shall be installed in one stile of pairs of doors and in jamb stiles of center pivoted doors.
 4. All entrance doors and frames shall be prepared for building security systems prior to installation.
- E. Finish
 1. Anodic
 - a. Finish all exposed areas of aluminum windows and components with electrolytically deposited color in accordance with Aluminum Association Designation
 - b. Exterior Storefront
 - 1) AA-M10-C22-A41 Color shall be Clear Anodized.
 - c. Interior Storefront
 - 1) AA-M10-C22-A44 Color shall be Black.

PART 3 EXECUTION

3.01 INSPECTION

- A. Job Conditions
 1. All openings shall be prepared by others to the proper size and shall be plumb, level, and in the proper location and alignment as shown on the architect's drawings.

3.02 INSTALLATION

- A. Use only skilled tradesmen with work done in accordance with approved shop drawings and specifications.
- B. Storefront system shall be erected plumb and true, in proper alignment and relation to established lines and grades.
- C. Entrance doors shall be securely anchored in place to a straight, plumb and level condition, without distortion. Weather stripping contact and hardware movement shall be checked and final adjustments made for proper operation and performance of units.

- D. Furnish and apply sealing materials to provide a weather tight installation at all joints and intersections and at opening perimeters.
- E. Sealing materials specified shall be used in strict accordance with the manufacturer's printed instructions, and shall be applied only by mechanics specially trained or experienced in their use. All surfaces must be clean and free of foreign matter before applying sealing materials. Sealing compounds shall be tooled to fill the joint and provide a smooth finished surface.
- F. 50% of the WV430 Storefront Window Systems should have ADA compliant hardware (AAMA 153; 5lbs force hardware). ADA units should be equally dispersed within the openings in scope, with at least unit being installed in each of the various spaces.
- G. Contractor to coordinate demolition of existing storefront windows and installation of new storefront windows to ensure weathertight conditions daily. Refer to selective demolition specification section for hazardous material remediation.
- H. Contractor to develop a replacement sequencing plan for the occupied portions of the building for owner's approval prior to the start of removal and installation of storefront windows. Sequencing plan to be reviewed during pre-mobilization.

3.03 ANCHORAGE

- A. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads.

3.04 PROTECTION AND CLEANING

- A. The general contractor shall protect the aluminum materials and finish against damage from construction activities and harmful substances. The general contractor shall remove any protective coatings as directed by the architect, and shall clean the aluminum surfaces as recommended for the type of finish applied.

END OF SECTION 08 41 13

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
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SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALL

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish and install architectural aluminum curtain wall complete with related components as shown on drawings and specified in this section.
- B. Basis of Design Curtain Wall System is EFCO Series 5600 Outside Glazed. Other approved manufacturers are as follows:
 - 1. Kawneer
 - 2. Oldcastle Building Envelope
 - 3. Capitol Aluminum and Glass
- C. Glass
 - 1. Reference Section 08 80 00 for Glass and Glazing.
- D. Single Source Requirement
 - 1. All products listed in Section 1.02 shall be by the same manufacturer.

1.02 RELATED WORK

- A. Section 08 41 13 - Aluminum - Framed Entrances and Storefronts with Vents

1.03 LABORATORY TESTING AND PERFORMANCE REQUIREMENTS

- A. Test Units
 - 1. Air, water, and structural test unit size shall be a minimum of two stories high and three lites wide.
 - 2. Thermal test unit sizes shall be 80" (2032 mm) wide x 80" (2032 mm) high with one intermediate vertical mullion and two lites of glass.
- B. Test Procedures and Performance
 - 1. Air Infiltration Test
 - a. Test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf (300 Pa).
 - b. Air infiltration shall not exceed .06 cfm/SF (.31 l/s•m²) of unit.
 - 2. Water Resistance Test
 - a. Test unit in accordance with ASTM E 331.
 - b. The test for static water penetration (ASTM E 331) shall be conducted at an air pressure difference of 15.0 psf (720 Pa). There shall be no water leakage as defined by AAMA 501.1, paragraph 5.5.
 - 3. Uniform Load Deflection Test
 - a. Test in accordance with ASTM E 330.
 - b. Deflection under design load shall not exceed L/175 for spans less than 162" (4114 mm).
 - c. Deflection under design load shall not exceed L/240 + 1/4" (6 mm) for spans greater than 162" (4114 mm).
 - 4. Uniform Load Structural Test
 - a. Test in accordance with ASTM E 330 at a pressure 1.5 times the design wind pressure in 1.05.B.3.b.
 - b. At conclusion of the test there shall be no glass breakage, permanent damage to fasteners, curtain wall parts, or any other damage that would cause the curtain wall to be defective.
 - 5. Condensation Resistance Test (CRF)
 - a. Test unit in accordance with AAMA 1503.1.
 - b. Condensation Resistance Factor (CRF) shall not be less than 66 (frame) when glazed with .29 center of glass U-Factor.
 - 6. Thermal Transmittance Test (Conductive U-Factor)

- a. With ventilators closed and locked, test unit in accordance with NFRC 100-2010.
 - b. Conductive thermal transmittance (U-Factor) shall not be more than .42 BTU/hr•ft²•°F
 - c. (2.38 W/m²•K) when glazed with .29 center of glass U-Factor.
- 7. Seismic Performance
 - a. Test unit in accordance to AAMA 501.4 system to meet design displacement of 0.010 x the greater adjacent story height and ultimate displacement of 1.5 x the design displacement.
- 8. Sound Transmission Loss
 - a. Test unit in accordance with ASTM E 90-02.
 - b. Sound Transmission Class (STC) shall not be less than 29.
- C. Project Wind Loads
 - 1. The system shall be designed to withstand the following loads normal to the plane of the wall:
 - a. Positive pressure of 18 psf at non-corner zones.
 - b. Negative pressure of 18 psf at non-corner zones.
 - c. Negative pressure of 20 psf at corner zones.

1.04 QUALITY ASSURANCE

- A. Provide test reports from AAMA accredited laboratories certifying the performance as specified in 1.05.
- B. Test reports shall be accompanied by the curtain wall manufacturer's letter of certification stating that the tested curtain wall meets or exceeds the referenced criteria for the appropriate curtain wall type.

1.05 SUBMITTALS

- A. Contractor shall submit shop drawings; finish samples, test reports, and warranties.
 - 1. Samples of materials as may be requested without cost to owner, i.e., metal, glass, fasteners, anchors, frame sections, mullion section, corner section, etc.

1.06 WARRANTIES

- A. Total Curtain Wall Installation
 - 1. The responsible contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total curtain wall installation. This includes the glass (including insulated units), glazing, anchorage and setting system, sealing, flashing, etc. as it relates to air, water, and structural adequacy and the specifications and approved shop drawings.
 - 2. Any deficiencies due to such elements not meeting the specifications shall be corrected by the responsible contractor at their expense during the warranty period.
- B. Window Material and Workmanship
 - 1. Provide written guarantee against defects in material and workmanship for 10 years from the date of final shipment.
- C. Glass
 - 1. Provide written warranty for insulated glass units, that they will be free from obstruction of vision as a result of dust or film formation on the internal glass surfaces caused by failure of the hermetic seal due to defects in material and workmanship.
 - 2. Warranty period shall be for 10 (ten) years.
- D. Finish
 - 1. Warranty period shall be for 10 years from the date of final shipment.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aluminum

1. Extruded aluminum shall be 6063-T6 alloy and temper.
- B. Glass
 1. Reference Section 08 80 00 for Glass and Glazing.
- C. Anchors
 1. Perimeter and floor line anchors shall be aluminum or steel. All steel anchors shall be properly insulated from the aluminum.
- D. Thermal Barrier
 1. The thermal barrier shall be extruded PVC used as an applied thermal isolator.

2.02 FABRICATION

- A. General
 1. All aluminum vertical and horizontal extrusions shall have a minimum wall thickness of .093" (2.3 mm) to .125" (3 mm).
 2. Manufacturer or fabricator to supply steel loading to meet necessary structural values in curtainwall spans where appropriate
- B. Frame
 1. Frame components shall be mechanically fastened by means of extruded aluminum shear blocks attached to vertical mullions.
 2. Curtain wall system is able to accommodate separate interior and exterior finishes and colors.
- C. Glazing
 1. Outside glazed curtain wall system shall be dry glazed with an exterior aluminum pressure plate and snap cover with interior and exterior dense EPDM preset gaskets.
- D. Finish
 1. Anodic
 - a. Finish all exposed areas of aluminum windows and components with electrolytically deposited color in accordance with Aluminum Association Designation
 - b. AA-M10-C22-A41 Color shall be Clear Anodized.
 - c. AA Description Description Arch. Class AAMA Guide Spec.
 - d. AA-M10-C22-A41 Clear Anodized 1 611-98

PART 3 EXECUTION

3.01 INSPECTION

- A. Job Conditions
 1. All openings shall be prepared by others to the proper size and shall be plumb, level, and in the proper location and alignment as shown on the architect's drawings.

3.02 INSTALLATION

- A. Use only skilled tradesmen with work done in accordance with approved shop drawings and established specifications, and erect all curtain wall components to all building bench marks and column center lines.
- B. Plumb and align curtain wall faces in a single plane for each wall plane, and erect curtain wall materials square and true. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, building movement, and specified wind loads.
- C. Adjust windows in curtain wall for proper operation after installation.
- D. Furnish and apply sealants to provide a weather tight installation at all joints and intersections and at opening perimeters. Wipe off excess material, leave all exposed surfaces and joints clean and smooth.
- E. Contractor to coordinate demolition of existing curtain wall and installation of new curtain walls to ensure weathertight conditions daily. Refer to selective demolition specification section for hazardous material remediation.

- F. Contractor to develop a replacement sequencing plan for the occupied portions of the building for owner's approval prior to the start of removal and installation of curtain wall. Sequencing plan to be reviewed during pre-mobilization.

3.03 ANCHORAGE

- A. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads.

3.04 PROTECTION AND CLEANING

- A. The general contractor shall protect the aluminum materials and finish against damage from construction activities and harmful substances. The general contractor shall remove any protective coatings as directed by the architect, and shall clean the aluminum surfaces as recommended for the type of finish applied.

END OF SECTION 08 44 13

SECTION 087100 – 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. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 4. Division 28 Section "Access Control".
- 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. Michigan Building Code 2015, 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. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. 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.
- E. 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.
- F. 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 Submittals.

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.
 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- 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 Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. 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. Seven years for heavy duty cylindrical (bored) locks and latches.
 - 3. Five years for exit hardware.
 - 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.

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.
- 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 the all out-swinging lockable doors.
 5. Manufacturers:
 - a. Hager Companies (HA).
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
 - c. Stanley Hardware (ST).

- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

- a. Hager Companies (HA).
- b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
- c. Stanley Hardware (ST).

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 sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets.

1. Manufacturers:

- a. Securitron (SU) – CEPT-10 Series.
- b. Von Duprin (VD) - EPT-10 Series.

2.4 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.

1. Manufacturers:

- a. Stanley Best (BE).
- b. No Substitution.

- B. 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.

- C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

- 1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

- D. 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: Key locks to Owner's existing system.
- E. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
 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).
- F. Construction Keying: Provide temporary keyed construction cores.
- G. 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.

2.5 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.
1. Mortise locks to be certified Security Grade 1.
 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) – ML2000 Series – to match existing.
- B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified.
1. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
 2. Locks are to be non-handed and fully field reversible.
 3. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.2 requirements to 2 million cycles.
 4. Manufacturers:
 - a. Corbin Russwin Hardware (RU) – CL3300 Series to match existing.

2.6 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.
- 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.

2.7 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. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
 - 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. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.

8. 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.
 9. 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.
 10. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 11. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 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. Exterior Doors - 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. Von Duprin (VD) - 35A/98 XP Series – to match existing.
- C. Exterior Doors - 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 to match existing.

2.8 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. Exterior Doors - Door Closers, Surface Mounted: 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 body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.
1. Manufacturers:
 - a. LCN Closers (LC) - 4040XP Series – to match existing.
- C. Interior Doors - 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. Norton Door Controls (NO) - 7500 Series – to match existing.

2.9 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. Burns Manufacturing (BU).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.10 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. Burns Manufacturing (BU).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Manufacturers:
 - a. Glynn Johnson (GJ).
 - b. Rixson Door Controls (RF).

2.11 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).
 - 2. Reese Enterprises, Inc. (RE).

2.12 ELECTRONIC ACCESSORIES

- A. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
 - 1. Manufacturers:
 - a. Securitron (SU) - BPS Series.
 - b. Von Duprin (VD) - PS.

2.13 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.

2.14 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: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from 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

- A. 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.
- B. 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.
- C. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RU - Corbin Russwin
4. AD - Adams Rite
5. VD - Von Duprin
6. SA - SARGENT
7. BE - dormakaba Best
8. RO - Rockwood
9. RF - Rixson
10. NO - Norton
11. LC - LCN Closers
12. SU - Securitron
13. OT - OTHER

Hardware Sets

Set: 1.0

Doors: 130A

1 Full Surface Cont. Hinge	CFS_CP-HD1	PE
1 Reuse Existing	Electric Power Transfer (EPT-10)	VD
1 Reuse Existing	Latch Bolt Monitor Strike	VD
1 Reuse Existing	Exit Device	VD
1 Mort. Cylinder	- match Owner's existing key system 626	BE
1 Core	- match Owner's existing key system 626	BE
1 Reuse Existing	Magnetic Lock	SC
1 Door Closer	4040XP REG- pull side mount AL	LC
1 Threshold	279x292AFGPK MSES25SS	PE
1 Weatherstrip	- integral within construction of door and frame assembly	00

1 Sweep	29326CNB x TKSP8	PE
1 Door Contact	- Provided by Section 281000	OT
1 Reuse Existing	Time Delay Module	VD
2 Reuse Existing	Card Readers	SC
1 Reuse Existing	Power Supply	SC

Notes: 24 Hour Mode: Door held locked by PACP / Card x PIN Required Entry / Card Required Egress / No Keyed Entry Override / Door position, Latch Blot, and Device Tamper Monitored through Access Control System by WSU-DPS.

Emergency Mode: Pressing on exit devcie will sound local alarm, door will unlock for egress after 15 second delay / TD initiate monitored remotely via access control system by WSU-DPS / TD initiate monitored locally via annunciator at reception desk / TD disabled and door unlocks upon fire alarm activation or power loss.

Set: 2.0

Doors: 125

1 Continuous Hinge	CFM-SLF-HD1 x PT	PE
1 Power Transfer	- Provided by Section 281000 (EPT-10)	VD
1 Electrified Deadlatch	- Provided by Section 281000 (4300-M)	628 AD ⚡
1 Paddle Operator	- Provided by Section 281000 (4591M)	US26D AD
1 Mort. Cylinder	- match Owner's existing key system	626 BE
1 Push Pull	RM251 x Mtg-Type 12XHD x Mtg-Type 11XHD	US32D-316 RO
1 Conc Overhead Stop	6-X36	630 RF
1 Door Closer	4040XP REG- pull side mount	AL LC
1 Threshold	279x292AFGPK MSES25SS	PE
1 Weatherstrip	- integral within construction of door and frame assembly	00
1 Sweep	29326CNB x TKSP8	PE
1 Door Contact	- Provided by Section 281000	OT
1 Power Supply	- Provided by Section 281000	VD
1 Card Reader	- Provided by Section 281000	00

Set: 2.1

Doors: 177B

1 Continuous Hinge	CFM-SLF-HD1 x PT	PE
1 Reuse Existing	Electric Power Transfer (EPT-10)	VD
1 Reuse Existing	Exit Device (EL-LXRLC-98DT)	VD

1 Rim Cylinder	- match Owner's existing key system	626	BE
1 Pull	RM201 x Mtg-Type 12XHD	US32D-316	RO
1 Conc Overhead Stop	6-X36	630	RF
1 Door Closer	4040XP - top jamb mount x mtg. plate as appropriate	AL	LC
1 Threshold	279x292AFGPK MSES25SS		PE
1 Weatherstrip	- integral within construction of door and frame assembly		00
1 Sweep	29326CNB x TKSP8		PE
1 Reuse Existing	Card Reader		SC
1 Reuse Existing	Power Supply		SC

Set: 3.0

Doors: 190.01

1 Continuous Hinge	CFM-SLF-HD1		PE
1 Rim Exit Device	CD 98NL	US26D	VD
1 Mort. Cylinder	- match Owner's existing key system	626	BE
1 Rim Cylinder	- match Owner's existing key system	626	BE
1 Pull	RM201 x Mtg-Type 12XHD	US32D-316	RO
1 Conc Overhead Stop	6-X36	630	RF
1 Door Closer	4040XP - top jamb mount x mtg. plate as appropriate	AL	LC
1 Threshold	279x292AFGPK MSES25SS		PE
1 Weatherstrip	- integral within construction of door and frame assembly		00
1 Sweep	29326CNB x TKSP8		PE
1 Door Contact	- Provided by Section 281000		OT

Notes: Function: Key outside retracts latch bolt. Keyed cylinder inside controls latch bolt dogging. Free egress always permitted.

Set: 4.0

Doors: 130B

6 Hinge (heavy weight)	T4A3786 / T4A4786	US26D	MK
2 Fire Exit Device (classroom)	12 43 NB8713 ETL	US32D	SA
2 Rim Cylinder	- match Owner's existing key system	626	BE
2 Surface Closer	CPS7500	689	NO
2 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Smoke / Sound Seal	S88D - head and jambs		PE

Notes: Key outside locks or unlocks lever trim. Free egress always permitted.

Doors: 090.02, 290.02

3 Hinge (heavy weight)	T4A3786 / T4A4786	US26D	MK
1 Fire Exit Device (passage)	12 43 8815 ETL	US32D	SA
1 Surface Closer	7500 - pull side mount	689	NO
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
1 Smoke / Sound Seal	S88D - head and jambs		PE

Notes: Passage lever trim.
Free egress always permitted.

Doors: 190.02

3 Hinge (heavy weight)	T4A3786 / T4A4786	US26D	MK
1 Fire Exit Device (passage)	12 43 8815 ETL	US32D	SA
1 Surface Closer	CPS7500	689	NO
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Smoke / Sound Seal	S88D - head and jambs		PE

Notes: Passage lever trim.
Free egress always permitted.

Doors: 190.00

3 Hinge (heavy weight)	T4A3786 / T4A4786	US26D	MK
1 Fire Exit Device (passage)	12 43 8815 ETL	US32D	SA
1 Surf Overhead Stop	9-X36 x LS	652	RF
1 Electromechanical Closer	7705PTO	689	NO
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Smoke / Sound Seal	S88D - head and jambs		PE

Notes: Passage lever trim.
Free egress always permitted.

Door held open by electromechanical hold open door closer. Install overhead stop with dead stop feature

("LS") at 5 degrees beyond hold open point of door closer. Door shall be reinforced for surface mount door hardware. Thru-bolt mounting of closer body and overhead stop are not permitted.

Power for electromechanical hold open closer shall be connected to fire alarm system in order that door shall close immediately upon activation of fire alarm.

Set: 8.0

Doors: 114

3 Hinge	TA2714 / TA4714	US26D	MK
1 Storeroom Lock	CL3357 NZD CTSD	626	RU
1 Core	- match Owner's existing key system	626	BE
1 Surf Overhead Stop	10-X36	652	RF
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
3 Silencer	608 / 609		RO

Notes: Function: Latch bolt operated by key outside or lever inside. Outside lever always rigid. Inside lever always free for egress.

Set: 9.0

Doors: 214

3 Hinge	TA2714 / TA4714	US26D	MK
1 Storeroom Lock	CL3357 NZD CTSD	626	RU
1 Core	- match Owner's existing key system	626	BE
1 Surf Overhead Hold Open	9-X26	652	RF
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
3 Silencer	608 / 609		RO

Notes: Function: Latch bolt operated by key outside or lever inside. Outside lever always rigid. Inside lever always free for egress.

Set: 10.0

Doors: 102.1, 102.2, 151B, 151C, 201, 203, 204, 206, 207, 209, 213, 215, 219, 221, 222, 224, 225

3 Hinge	TA2714 / TA4714	US26D	MK
1 Entrance Lock	CL3351 NZD CTSD	626	RU
1 Core	- match Owner's existing key system	626	BE
1 Wall Stop	409	US32D	RO
3 Silencer	608 / 609		RO

Notes: Function: Latch operated by lever either side except when turn button locks outside lever. Pushing turn button inside locks outside lever, requiring use of key outside to unlock. Turning inside lever unlocks outside lever (when button is pushed in but not turned). Pushing in and turning inside button locks outside lever, requiring key at all times. Turning inside lever does not unlock outside lever until button is manually turned to unlocked position. Inside lever always free for egress.

Set: 11.0

Doors: 200

3 Hinge	TA2714 / TA4714	US26D	MK
1 Classroom Lock	CL3355 NZD CTSD	626	RU
1 Core	- match Owner's existing key system	626	BE
1 Conc Overhead Stop	2-X36	652	RF
3 Silencer	608 / 609		RO

Notes: Function: Latch bolt by lever either side unless outside lever is locked by key outside. Outside lever remains locked unless unlocked by key. Inside lever always free for egress.

Set: 12.0

Doors: 015, 025, 216

3 Hinge	TA2714 / TA4714	US26D	MK
1 Institutional Privacy Lock	ML2069 NSA M34 M19V CT7SD	626	RU
1 Core	- match Owner's existing key system	626	BE
1 Surface Closer	7500 - pull side mount	689	NO
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608 / 609		RO
1 Coat Hook	796	US26D	RO

Notes: Latch bolt operated by lever either side, except when outside lever is locked by thumb turn inside. Operating inside lever or closing door unlocks outside lever. Key outside retracts latch at all times, even if thumb turn is held in locked position.

Install coat hook at 48" centerline above floor.

Set: 13.0

Doors: 102B, 230A

3 Hinge (heavy weight)	T4A3786 / T4A4786	US26D	MK
1 Entrance Lock	CL3351 NZD CTSD	626	RU
1 Core	- match Owner's existing key system	626	BE

1 Surface Closer	CPS7500	689	NO
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Smoke / Sound Seal	S88D - head and jambs		PE

Notes: Function: Latch operated by lever either side except when turn button locks outside lever. Pushing turn button inside locks outside lever, requiring use of key outside to unlock.
Turning inside lever unlocks outside lever (when button is pushed in but not turned). Pushing in and turning inside button locks outside lever, requiring key at all times. Turning inside lever does not unlock outside lever until button is manually turned to unlocked position.
Inside lever always free for egress.

Set: 14.0

Doors: 102A

3 Hinge (heavy weight)	T4A3786 / T4A4786	US26D	MK
1 Entrance Lock	CL3351 NZD CTSD	626	RU
1 Core	- match Owner's existing key system	626	BE
1 Surface Closer	CPS7500	689	NO
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Smoke / Sound Seal	S88D - head and jambs		PE

Notes: Function: Latch operated by lever either side except when turn button locks outside lever. Pushing turn button inside locks outside lever, requiring use of key outside to unlock.
Turning inside lever unlocks outside lever (when button is pushed in but not turned). Pushing in and turning inside button locks outside lever, requiring key at all times. Turning inside lever does not unlock outside lever until button is manually turned to unlocked position.
Inside lever always free for egress.

Set: 15.0

Doors: 108, 110

3 Hinge (heavy weight)	T4A3786 / T4A4786	US26D	MK
1 Classroom Lock	CL3355 NZD CTSD	626	RU
1 Core	- match Owner's existing key system	626	BE
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608 / 609		RO

Notes: Function: Latch bolt by lever either side unless outside lever is locked by key outside. Outside lever remains locked unless unlocked by key. Inside lever always free for egress.

Set: 16.0

Doors: 001, 005

3 Hinge (heavy weight)	T4A3786 / T4A4786	US26D	MK
1 Classroom Intruder Lock	CL3352 NZD CTSD	626	RU
2 Core	- match Owner's existing key system	626	BE
1 Surface Closer	PR7500	689	NO
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
1 Smoke / Sound Seal	S88D - head and jambs		PE

Notes: Key from either side locks and unlocks lever outside.
Key from either side retracts latch bolt.
Lever outside retracts latch bolt, except when outside lever is locked by key.
Lever inside always retracts latch bolt for egress.

Set: 17.0

Doors: 023

3 Hinge (heavy weight)	T4A3786 / T4A4786	US26D	MK
1 Classroom Intruder Lock	CL3352 NZD CTSD	626	RU
2 Core	- match Owner's existing key system	626	BE
1 Surface Closer	CPS7500	689	NO
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Smoke / Sound Seal	S88D - head and jambs		PE

Notes: Key from either side locks and unlocks lever outside.
Key from either side retracts latch bolt.
Lever outside retracts latch bolt, except when outside lever is locked by key.
Lever inside always retracts latch bolt for egress.

Set: 18.0

Doors: 101

3 Hinge (heavy weight)	T4A3786 / T4A4786	US26D	MK
1 Institutional Privacy Lock	ML2069 NSA M34 M19V CT7SD	626	RU
1 Core	- match Owner's existing key system	626	BE
1 Surface Closer	7500 - pull side mount	689	NO
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
1 Smoke / Sound Seal	S88D - head and jambs		PE

Notes: Latch bolt operated by lever either side, except when outside lever is locked by thumb turn inside.
Operating inside lever or closing door unlocks outside lever. Key outside retracts latch at all times, even if thumb turn is held in locked position.

END OF SECTION 087100

SECTION 08 80 00 - GLAZING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes:
 - 1. Glass for windows, doors, interior borrowed lites, and storefront framing.
 - 2. Double-glazed solar control insulating glass units
 - 3. Glazing sealants and accessories.

1.03 REFERENCES

- A. ANSI Z 97.1 - Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.
- B. ASTM C 1036 - Standard Specification for Flat Glass.
- C. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
- D. ASTM C 1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
- E. ASTM E 2188 - Standard Test Method for Insulating Glass Unit Performance.
- F. ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
- G. CPSC 16CFR-1201 - Safety Standard for Architectural Glazing Materials.
- H. Glass Association of North America (GANA) Glazing Manual.

1.04 DEFINITIONS

- A. Sealed Insulating Glass Unit Surfaces:
 - 1. Surface No. 1: Exterior surface of outer lite.
 - 2. Surface No. 2: Interior surface of outer lite.
 - 3. Surface No. 3: Exterior surface of inner lite.
 - 4. Surface No. 4: Interior surface of inner lite.
- B. Airspace: Space between lites of an insulating glass unit that contains dehydrated air or other inert specified gas.

1.05 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.06 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. VOC Data:
 - 1. Product Data for field-applied glazing sealants, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for glazing sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.07 INFORMATIONAL SUBMITTALS

- A. Preconstruction adhesion and compatibility test report.

1.08 QUALITY ASSURANCE

- A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- B. DELIVERY, STORAGE, AND HANDLING
 - 1. Delivery:
 - a. Deliver glass to site in accordance with manufacturer's instructions.
 - b. Deliver glass in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer.
 - 2. Storage:
 - a. Store glass in accordance with manufacturer's instructions.
 - b. Store glass in clean, dry area indoors.
 - c. Protect from exposure to direct sunlight and freezing temperatures.
 - d. Apply temporary coverings loosely to allow adequate ventilation.
 - e. Protect from contact with corrosive chemicals.
 - f. Avoid placement of glass edge on concrete, metal, and other hard objects.
 - g. Rest glass on clean, cushioned pads at 1/4-points.
 - 3. Handling:
 - a. Handle glass in accordance with manufacturer's instructions.
 - b. Protect glass from damage during handling and installation.
 - c. Do not slide 1 lite of glass against another.
 - d. Do not use sharp objects near unprotected glass.

1.09 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.10 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Glass Product: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:
 - 1. Guardian Glass, LLC, 2300 Harmon Road, Auburn Hills, Michigan 48326. Toll Free (866) 482-7374. Phone (248) 340-1800. Web Site www.guardianglass.com.
 - 2. AGC Industries Inc.
 - 3. Vitro Architectural
 - 4. Viracon, Inc.

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design glazing.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E 1300.
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Design Snow Loads: As indicated on Drawings but not less than snow loads applicable to Project as required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7.0, "Snow Loads."
 - 3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with basic-protection testing requirements in ASTM E 1996 for Wind Zone 4 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.
 - 1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 - 2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - 3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.03 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: "Glazing Manual."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having

jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass[as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.04 GLASS PRODUCTS

- A. Refer to Glass Schedule
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- C. SOLAR CONTROL INSULATING COATED GLASS
 - 1. Double-Glazed Sputter-Coated Insulating Glass Units:
 - a. Conformance: ASTM E 2190.
 - b. Outboard Lite: Sputter-coated Guardian UltraClear® low-iron clear float glass.
 - 1) Annealed Clear Float Glass: ASTM C 1036, Type 1, Class 1, Quality q3.
 - 2) Vacuum Deposition Sputtered Coating: ASTM C 1376.
 - 3) Coating on Surface No. 2: SunGuard SNR 43.
 - 4) Glass Thickness: 6 mm (1/4 inch).
 - 5) Heat Treatment: [Heat-strengthened, ASTM C 1048, Kind HS] or [Tempered; ASTM C 1048, Kind FT; CPSC 16CFR-1201; ANSI Z 97.1]
 - c. Air Space: 12 mm (1/2 inch) wide, hermetically sealed, dehydrated air space.
 - d. Inboard Lite: Guardian UltraClear® low-iron clear float glass.
 - 1) Annealed Clear Float Glass: ASTM C 1036, Type 1, Class 1, Quality q3.
 - 2) Glass Thickness: 6 mm (1/4 inch).
 - 3) Heat-Treatment: [Heat-strengthened, ASTM C 1048, Kind HS] or [Tempered; ASTM C 1048, Kind FT; CPSC 16CFR-1201; ANSI Z 97.1].
 - e. Glass Unit Performance Characteristics:
 - 1) Visible Light Transmittance: 45 percent
 - 2) Visible Light Reflectance Outdoors: 28 percent
 - 3) Direct Solar Energy Transmittance: 21 percent
 - 4) Direct Solar Energy Reflectance Outdoors: 54 percent
 - 5) Winter U-Value Nighttime: 0.29
 - 6) Summer U-Value Daytime: 0.27
 - 7) Solar Heat Gain Coefficient: 0.23
 - 8) Summer Relative Heat Gain: 56
 - f. Edge Seals: ASTM E 2188, with aluminum spacers, dual-sealed with a primary seal of polyisobutylene and a secondary seal of silicone sealant for glass-to-spacer seals.
 - g. Sealant: Approved by glass manufacturer.

2.05 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with Division 07 Section "Joint Sealants" and the following requirements:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under

conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Field-applied sealants shall have a VOC content of not more than 250 g/L.
4. Sealants shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
5. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.06 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.07 MISCELLANEOUS GLAZING MATERIALS

- A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.08 FABRICATORS

- A. Acceptable Fabricators: Certified by glass manufacturer.

2.09 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.
- C. Verify glazing openings are correct size and within tolerance.
- D. Verify glazing channels, recesses, and weeps are clean and free of obstructions.

3.03 FIELD QUALITY CONTROL

- A. Coated glass, when viewed from minimum of 10 feet, exhibiting slightly different hue or color not apparent in hand samples, will not be cause of rejection of glass units, as determined by Architect.
- B. Verify glass is free of chips, cracks, and other inclusions that could inhibit structural or aesthetic integrity.

3.04 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.05 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Apply heel bead of elastomeric sealant.
- F. Do not remove release paper from tape until right before each glazing unit is installed.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.06 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.07 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

3.08 PROTECTION

- A. Protect installed glass from damage during construction.
- B. Protect installed glass from contact with contaminating substances resulting from construction operations.
- C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

3.09 GLASS SCHEDULE

- A. Glass Type GL-1 (interior & exterior non-rated glazing): Clear fully tempered float glass.
 1. Minimum Thickness: 6 mm.
 2. Tempered glazing required.
- B. Glass Type GL-2 (interior non-rated glazing): Clear float glass.
 1. Minimum Thickness: 6 mm.
 2. Heat Strengthened required
- C. Glass Type GL-3 (interior rated glazing): Refer to section 088117
- D. Glass Type GL-4 (exterior insulated safety glazing)
 1. Basis of Design: Guardian SunGuard SNR 43 Ultra Clear - Ultra Clear
 2. Tempered glazing required
- E. Glass Type GL-5 (exterior insulated glazing)
 1. Basis of Design: Guardian SunGuard SNR 43 Ultra Clear - Ultra Clear
 2. Heat Strengthened required

END OF SECTION 08 80 00

SECTION 08 81 17 - FIRE-RATED GLASS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Fire-rated glazing materials installed as vision lights in fire-rated doors.
 - 2. Fire-rated glazing materials installed as transoms, borrowed lites, windows in fire-rated frames.
- B. Related Sections include the following:
 - 1. Section 08 11 00 "Metal Doors and Frames" for vision panels in interior doors and interior vision panel (borrowed lites) frames.

1.03 REFERENCES

- A. ASTM E2074-00: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
- B. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.
- C. American National Standards Institute (ANSI):
 - 1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings
- D. Consumer Product Safety Commission (CPSC):
 - 1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials
- E. Glass Association of North America (GANA):
 - 1. GANA - Glazing Manual.
 - 2. FGMA - Sealant Manual.
- F. National Fire Protection Association (NFPA):
 - 1. NFPA 80: Fire Doors and Windows.
 - 2. NFPA 252 - Fire Tests of Door Assemblies.
 - 3. NFPA 257 - Fire Tests of Window Assemblies.
- G. Underwriters Laboratories, Inc. (UL):
 - 1. UL 9 - Fire Tests of Window Assemblies.
 - 2. UL 10B - Fire Tests of Door Assemblies.
 - 3. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
- H. Standard Council of Canada:
 - 1. ULC Standard CAN4-S104: Fire Tests of Door Assemblies.
 - 2. ULC Standard CAN4-S106: Fire Tests of Window Assemblies.
 - 3. CAN/ULC-S101M: Standard Methods of Fire Endurance Tests.
- I. 2009 Michigan Building Code
- J. NFPA 101-1997

1.04 PERFORMANCE REQUIREMENTS

- A. GL-3: Fire-rated glass ceramic laminated clear and wireless glazing material for use in impact safety-rated locations such as doors, transoms and borrowed lites with fire rating requirements ranging from 20 minutes to 3 hours with required hose stream test.
 - 1. Passes positive pressure test standards UL10C, UBC 7-2 and UBC 7-4.

1.05 SUBMITTALS

- A. Comply with requirements of Section 01 33 00.

- B. Product Data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.
- C. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.
- D. Product Test Listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.
- E. Samples: Submit, for verification purposes, approx. 8-inch by 10-inch sample for each type of glass indicated.

1.06 QUALITY ASSURANCE

- A. Glazing Standards: FGMA Glazing Manual and Sealant Manual.
- B. Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.
- C. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E2074-00 and UL 10B, labeled and listed by UL.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to specified destination in manufacturer or distributor's packaging, undamaged, complete with installation instructions.
- B. Store off ground, under cover, protected from weather and construction activities.
- C. Do not expose GL-2 to temperatures greater than 120 degrees or less than minimum 40 degrees F during storage and transportation.
- D. Do not expose the non-PVB side of glass to UV light.
- E. Store sheets of glass vertically. DO NOT lean.

1.08 WARRANTY

- A. Provide manufacturer's limited warranty
- B. Warranty Period: Five years from date of purchase.

PART 2 PRODUCTS

2.01 FIRE-RATED GLAZING MATERIALS

- A. GL-3 Design Standard: Manufacturer: FireLite Plus® as manufactured by Nippon Electric Glass Company, Ltd., and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065, voice 1-800-426-0279, fax 1-800-451-9857,
- B. e-mail sales@fireglass.com, web site www.fireglass.com.
 - 1. Properties:
 - a. Thickness: 5/16 inch [8 mm] overall.
 - b. Weight: 4 lbs./sq. ft.
 - c. Approximate Visible Transmission: 85 percent.
 - d. Approximate Visible Reflection: 9 percent.
 - e. Fire-rating: 20 minutes to 3 hours for doors; 20 minutes to 90 minutes for other applications.
 - f. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
 - g. STC Rating: Approximately 38 dB.
 - h. Surface Finish:
 - i. Premium Grade-Ground and polished on both sides

- j. Standard Grade-Comparable surface finish to alternative fire-rated ceramic products marketed as "Premium"
- k. Positive Pressure Test: UL 10C, UBC 7-2 and 7-4; passes.
- 2. Labeling: Permanently label each piece of glass with the manufacturer logo, UL logo and fire rating in sizes up to 3,325 sq. in.
- 3. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with NPFA 252 and NFPA 257, UL 9, UL 10B and UL 10C.
- C. Permanently label each piece of glass with the appropriate marking.
- D. Fire Rating - 60 Minutes and Greater: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E 119 and UL 263.

2.02 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

- 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 percent. Glass panels that exceed 1,393 sq. inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.
- 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 795 - Dow Corning Corp.
 - 2. Silglaze-II 2800 - General Electric Co.
 - 3. Spectrem 2 - Tremco Inc.
- C. Setting Blocks:
 - 1. For GL-1: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.
 - 2. For GL-2: Hardwood or calcium silicate; glass width by 4 inches by 3/16 inch thick.
- D. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified glazing compound.
- E. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.03 FABRICATION

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
 - 2. Minimum required face or edge clearances.
 - 3. Observable edge damage or face imperfections.
- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.
- C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.02 INSTALLATION (GLAZING)

- A. Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.
- B. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
- C. Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.
- D. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.
- E. Place setting blocks located at quarter points of glass with edge block no more than 6 inches from corners.
- F. Glaze vertically into labeled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
- G. Place glazing tape on free perimeter of glazing in same manner described above.
- H. Do not remove protective edge tape.
- I. Install removable stop and secure without displacement of tape.
- J. Do not pressure glaze
- K. Install in vision panels in fire-rated doors to requirements of NFPA 80.
- L. For GL-2, Apply cap bead of silicone sealant along void between the stop and the glazing, to uniform line, with bevel to form watershed away from glass. Tool or wipe sealant surface smooth.
- M. For GL-2, Provide minimum 3/16 inch edge clearance.
- N. Install so that appropriate UL markings remain permanently visible.

3.03 PROTECTION AND CLEANING

- A. Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by glass manufacturer.
- B. Wash glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

3.04 GLAZING SCHEDULE FOR GL-3

RATING	ASSEMBLY	MAX. EXPOSED AREA (SQ. IN.)	MAX. WIDTH OF EXPOSED GLAZING (IN.)	OR	MAX. HEIGHT OF EXPOSED GLAZING (IN.)	STOP HEIGHT
20 MIN.	DOORS HMS OR WOOD* FIREFRAMES D.S. OTHER THAN DOORS HMS OR WOOD FIREFRAMES D.S.	3,204 3,204 3,325 3,325	36 36 95 95		89 89 95 95	5/8" 3/4" 5/8" 3/4"

45 MIN.	DOORS HMS OR WOOD FIREFRAMES D.S. OTHER THAN DOORS HMS OR WOOD FIREFRAMES D.S.	3,204 3,204 3,325 3,325	36 36 95 95	89 89 95 95	5/8" 3/4" 5/8" 3/4"
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3.05 * HMS INDICATES HOLLOW METAL STEEL FRAMING. FIREFRAMES D.S. INDICATES DESIGNER SERIES NARROW PROFILE FRAMING. FOR WOOD FRAMES, CHECK WITH MANUFACTURER FOR MAXIMUM TESTED GLASS SIZES.

END OF SECTION 08 81 17

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 09 01 90.52 - MAINTENANCE REPAINTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes maintenance repainting as follows:
 - 1. Removing existing paint.
 - 2. Patching substrates.
 - 3. Preparation for repainting.
- B. Related Requirements:
 - 1. Division 01 Section "Alteration Project Procedures" for general remodeling, renovation, repair, and maintenance requirements.
 - 2. Division 04 Section "Masonry Cleaning" for cleaning and removing paint from masonry.
 - 3. Division 09 Section "Interior Painting" for Painting.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product List: Printout of current "MPI Approved Products List" for each MPI-product category specified in paint systems, with the proposed product highlighted.

1.04 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 daily.

1.05 FIELD CONDITIONS

- A. Weather Limitations: Proceed with maintenance repainting only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.
- B. 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).
- C. Do not apply paint 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.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer for surface preparation and during paint application and drying periods.

PART 2 PRODUCTS

2.01 PREPARATORY CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F.
- C. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for every 5 gal. of solution required.
- D. Mildewcide: Commercial proprietary mildewcide or a job-mixed solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.

- E. Abrasives for Ferrous Metal Cleaning: Aluminum oxide paper, emery paper, fine steel wool, steel scrapers, and steel-wire brushes of various sizes.
- F. Rust Remover: Manufacturer's standard phosphoric acid-based gel formulation, also called "naval jelly," for removing corrosion from iron and steel.

2.02 PAINT REMOVERS

- A. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste or gel formulation for removing paint from masonry, stone, wood, plaster, or metal as required to suit Project; and containing no methylene chloride.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABR Products, Inc.; 800 Brush Grade.
 - b. Diedrich Technologies Inc., a division of Sandell Construction Solutions; 606 Multi-Layer Paint Remover or 606X Extra Thick Multi-Layer Paint Remover.
 - c. EaCo Chem, Inc.; Stripper Cream.
 - d. PROSOCO, Inc.; Sure Klean Heavy-Duty Paint Stripper.
 - e. Shore Corporation; 2200 Alka Strip.
- B. Low-Odor, Solvent-Type Paste Paint Remover: Manufacturer's standard low-odor, water-rinsable, solvent-type paste, gel, or foamed emulsion formulation for removing paint from masonry, stone, wood, plaster, or metal as required to suit Project; and containing no methanol or methylene chloride.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABR Products, Inc.; ABR Citrus Paint Removers or Super Bio Strip Gel.
 - b. Cathedral Stone Products, Inc.; S-301, S-303 or S-305.
 - c. Dumond Chemicals, Inc.; Peel Away 7 without paper covering Smart Strip or Smart Strip Pro.
 - d. EaCo Chem, Inc.; InStrip.
 - e. PROSOCO, Inc.; Enviro Klean SafStrip or Enviro Klean SafStrip 8.

2.03 PAINT, GENERAL

- A. 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.
- B. Colors: As indicated with each paint system in Division 09 Section "Interior Painting."

2.04 PAINT MATERIALS, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.05 PATCHING MATERIALS

- A. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be designed for filling voids in damaged wood materials that have deteriorated from weathering and decay. Compound shall be capable of filling deep holes and spreading to feather edge.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Abatron, Inc.; LiquidWood with WoodEpoxy.

- b. Advanced Repair Technology, Inc.; Primatrate with Flex-Tec HV.
 - c. ConServ Epoxy LLC; Flexible Epoxy Consolidant 100 with Flexible Epoxy Patch 200.
 - d. Gougeon Brothers, Inc.; West System (thickened with filler).
 - e. Polymeric Systems, Inc.; QuickWood.
 - f. Protective Coating Company; PC-Woody.
 - g. System Three Resins, Inc.; Sulpwood.
- B. Metal-Patching Compound: Two-part, polyester-resin, metal-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of metal repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be produced for filling metal that has deteriorated from corrosion. Filler shall be capable of filling deep holes and spreading to feather edge.
- C. Cementitious Patching Compounds: Cementitious patching compounds and repair materials specifically manufactured for filling cementitious substrates and for sanding or tooling prior to repainting; formulation as recommended in writing by manufacturer for type of cementitious substrate indicated, exposure to weather and traffic, the detail of work, and site conditions.
- D. Gypsum-Plaster Patching Compound: Finish coat plaster and bonding compound according to ASTM C 842 and manufacturer's written instructions.

PART 3 EXECUTION

3.01 MAINTENANCE REPAINTING, GENERAL

- A. Execution of the Work: In repainting surfaces, disturb them as minimally as possible and as follows:
- 1. Remove failed coatings and corrosion and repaint.
 - 2. Verify that substrate surface conditions are suitable for repainting.
 - 3. Allow other trades to repair items in place before repainting.
- B. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use gentle methods, such as scraping and lightly hand sanding, that will not abrade softer substrates, reducing clarity of detail.
- C. Heat Processes: Do not use torches, heat guns, or heat plates.

3.02 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of painting work. Comply with paint manufacturer's written instructions for inspection.
- B. Alkalinity: Do not begin application of coatings unless surface alkalinity is within range recommended in writing by paint manufacturer. Conduct alkali testing with litmus paper on exposed plaster, cementitious, and masonry surfaces.

3.03 PREPARATORY CLEANING

- A. General: Use the gentlest, appropriate method necessary to clean surfaces in preparation for painting. Clean all surfaces, corners, contours, and interstices.
- B. Detergent Cleaning: Wash surfaces by hand using clean rags, sponges, and bristle brushes. Scrub surface with detergent solution and bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet. Rinse with water applied by clean rags or sponges.
- C. Solvent Cleaning: Use solvent cleaning to remove oil, grease, smoke, tar, and asphalt from painted or unpainted surfaces before other preparation work. Wipe surfaces with solvent using clean rags and sponges. If necessary, spot-solvent cleaning may be employed just prior to commencement of paint application, provided enough time is allowed for complete evaporation. Use clean solvent and clean rags for the final wash to ensure that all foreign materials have been removed. Do not use solvents, including primer thinner and turpentine that leave residue.

- D. Mildew: Clean off existing mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. Rinse with water applied by clean rags or sponges.
- E. Chemical Rust Removal:
 - 1. Remove loose rust scale with specified abrasives for ferrous-metal cleaning.
 - 2. Apply rust remover with brushes or as recommended in writing by manufacturer.
 - 3. Allow rust remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing. Do not allow extended dwell time.
 - 4. Wipe off residue with mineral spirits and either steel wool or soft rags, or clean with method recommended in writing by manufacturer to remove residue.
 - 5. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
 - 6. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.
- F. Mechanical Rust Removal:
 - 1. Remove rust with specified abrasives for ferrous-metal cleaning. Clean to bright metal.
 - 2. Wipe off residue with mineral spirits and either steel wool or soft rags.
 - 3. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
 - 4. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.

3.04 PAINT REMOVAL

- A. General: Remove paint where indicated. Where cleaning methods have been attempted and further removal of the paint is required because of incompatible or unsatisfactory surfaces for repainting, remove paint to extent required by conditions.
 - 1. Brushes: Use brushes that are resistant to chemicals being used.
 - a. Metal Substrates: If using wire brushes on metal, use brushes of same metal composition as metal being treated.
 - b. Wood Substrates: Do not use wire brushes.
 - 2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that spray methods do not damage surfaces.
 - a. Equip units with pressure gages.
 - b. Unless otherwise indicated, hold spray nozzle at least 6 inches from surface and apply material in horizontal, back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
 - c. For chemical spray application, use low-pressure tank or chemical pump suitable for chemical indicated, equipped with nozzle having a cone-shaped spray.
 - d. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 - e. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
- B. Paint Removal with Hand Tools: Remove paint manually using hand-held scrapers, wire brushes, sandpaper, and metallic wool as appropriate for the substrate material.
- C. Paint Removal with Alkaline Paste Paint Remover:
 - 1. Remove loose and peeling paint using scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - 2. Apply paint remover to dry, painted surface with brushes.
 - 3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
 - 4. Use mechanical methods recommended in writing by manufacturer to remove chemicals and paint residue.
 - 5. Repeat process if necessary to remove all paint.
- D. Paint Removal with Low-Odor, Solvent-Type Paste Paint Remover:

1. Remove loose and peeling paint using scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply thick coating of paint remover to dry, painted surface with natural-fiber cleaning brush, deep-nap roller, or large paintbrush. Apply in one or two coats according to manufacturer's written instructions.
3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
4. Use mechanical methods recommended in writing by manufacturer to remove chemicals and paint residue.
5. Repeat process if necessary to remove all paint.

3.05 SUBSTRATE REPAIR

- A. General: Repair substrate surface defects that are inconsistent with the surface appearance of adjacent materials and finishes.
- B. Wood Substrate:
 1. Repair wood defects including dents and gouges more than 1/8 inch in size and all holes and cracks by filling with wood-patching compound and sanding smooth. Reset or remove protruding fasteners.
 2. Where existing paint is allowed to remain, sand irregular buildup of paint, runs, and sags to achieve a uniformly smooth surface.
- C. Cementitious Material Substrate:
 1. General: Repair defects including dents and chips more than 1/4 inch in size and all holes and cracks by filling with cementitious patching compound and sanding smooth. Remove protruding fasteners.
 2. New and Bare Plaster: Neutralize surface of plaster with mild acid solution as recommended in writing by paint manufacturer. In lieu of acid neutralization, follow manufacturer's written instruction for primer or transition coat over alkaline plaster surfaces.
 3. Concrete, Cement Plaster, and Other Cementitious Products: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. If surfaces are too alkaline to paint, correct this condition before painting.
- D. Gypsum-Plaster and Gypsum-Board Substrates:
 1. Repair defects including dents and chips more than 1/8 inch in size and all holes and cracks by filling with gypsum-plaster patching compound and sanding smooth. Remove protruding fasteners.
 2. Rout out surface cracks to remove loose, unsound material; fill with patching compound and sand smooth.
- E. Metal Substrate:
 1. Preparation: Treat repair locations by wire-brushing and solvent cleaning. Use chemical or mechanical rust removal method to clean off rust.
 2. Defects in Metal Surfaces: Repair non-load-bearing defects in existing metal surfaces, including dents and gouges more than 1/16 inch deep or 1/2 inch across and all holes and cracks by filling with metal-patching compound and sanding smooth. Remove burrs and protruding fasteners.
 3. Priming: Prime iron and steel surfaces immediately after repair to prevent flash rusting. Prime paint corners, crevices, bolts, welds, and sharp edges. Apply two coats to surfaces that are inaccessible after completion of the Work.

3.06 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage paint-remover manufacturer's factory-authorized service representative for consultation and Project-site inspection and to provide on-site assistance when requested by Architect.

3.07 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.08 SURFACE-PREPARATION SCHEDULE

- A. General: Before painting, prepare surfaces for painting according to applicable requirements specified in this schedule.
 - 1. Examine surfaces to evaluate each surface condition according to paragraphs below.
 - 2. Where existing degree of soiling prevents examination, preclean surface and allow it to dry before making an evaluation.
 - 3. Repair substrate defects according to "Substrate Repair" Article.
- B. Surface Preparation for MPI DSD 0 Degree of Surface Degradation:
 - 1. Surface Condition: Existing paint film in good condition and tightly adhered.
 - 2. Paint Removal: Not required.
 - 3. Preparation for Painting: Wash surface by detergent cleaning; use solvent cleaning where needed. Roughen or degloss cleaned surfaces to ensure paint adhesion according to paint manufacturer's written instructions.
- C. Surface Preparation for MPI DSD 1 Degree of Surface Degradation:
 - 1. Surface Condition: Paint film cracked or broken but adhered.
 - 2. Paint Removal: Scrape by hand-tool cleaning methods to remove loose paint until only tightly adhered paint remains.
 - 3. Preparation for Painting: Wash surface by detergent cleaning; use other cleaning methods for small areas of bare substrate if required. Roughen, degloss, and sand the cleaned surfaces to ensure paint adhesion and a smooth finish according to paint manufacturer's written instructions.
- D. Surface Preparation for MPI DSD 2 Degree of Surface Degradation:
 - 1. Surface Condition: Paint film loose, flaking, or peeling.
 - 2. Paint Removal: Remove loose, flaking, or peeling paint film by hand-tool or chemical paint-removal methods.
 - 3. Preparation for Painting: Wash surface by detergent cleaning; use solvent cleaning where needed. Use other cleaning methods for small areas of bare substrate if required. Sand surfaces to smooth remaining paint film edges. Prepare bare cleaned surface to be painted according to paint manufacturer's written instructions for substrate construction materials.
- E. Surface Preparation for MPI DSD 3 Degree of Surface Degradation:
 - 1. Surface Condition: Paint film severely deteriorated (heavy peeling, flaking, cracking, checking, scratches, scuffs, abrasion, small holes and gouges).
 - 2. Paint Removal: Completely remove paint film by hand-tool or chemical paint-removal methods. Remove rust.
 - 3. Preparation for Painting: Prepare bare cleaned surface according to paint manufacturer's written instructions for substrate construction materials.
- F. Surface Preparation for MPI DSD 4 Degree of Surface Degradation:
 - 1. Surface Condition: Missing material, small holes and openings, and deteriorated or corroded substrate.

2. Substrate Preparation: Repair, replace, and treat substrate according to "Substrate Repair" Article and requirements in other Specification Sections for materials that have been damaged.
3. Preparation for Painting: Sand substrate surfaces to smooth remaining paint film edges and prepare according to paint manufacturer's written instructions for substrate construction materials. Remove rust.
4. Painting: Paint as required for MPI DSD 2 degree of surface degradation.

END OF SECTION 09 01 90.52

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
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SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceilings and soffits.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested according to ASTM E 119.
- B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413.

2.02 FRAMING SYSTEMS

- A. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.
 - 1. Minimum Base-Metal Thickness: 0.033 inch.
 - 2. Depth: As indicated on Drawings.
- B. Slip-Type Head Joints: Where indicated, provide one of the following in thickness not less than indicated for studs and in width to accommodate depth of studs:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges and fastened to studs, and outer runner sized to friction fit inside runner.
 - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes due to deflection of structure above.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
 - 2) MBA Building Supplies; FlatSteel Deflection Track or Slotted Deflecto Track.
 - 3) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
 - 4) Superior Metal Trim; Superior Flex Track System (SFT).
 - 5) Telling Industries; Vertical Slip Track or Vertical Slip Track II.
- C. Firestop Tracks: Manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Grace Construction Products; FlameSafe FlowTrak System.
 - b. Metal-Lite, Inc.; The System.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 16 ga. minimum.

- E. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.018 inch.
 - 2. Depth: As indicated on Drawings.
- G. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical or hat shaped.
- H. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.03 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Anchors: Capable of sustaining a load equal to 5 times that imposed as determined by ASTM E 488.
 - a. Type: Postinstalled, chemical anchor or Postinstalled, expansion anchor.
 - 2. Powder-Actuated Fasteners: Capable of sustaining, a load equal to 10 times that imposed as determined by ASTM E 1190.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches.
- E. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 - 2. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.
 - a. Minimum Base-Metal Thickness: 0.033 inch.
 - b. Depth: As indicated on Drawings.
 - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: 0.018 inch.
 - 4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.

2.04 AUXILIARY MATERIALS

- A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide asphalt saturated organic felt or foam gasket.

- C. Sound Attenuation Blankets: As specified in Division 09 Section "Acoustic Insulation."
- D. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.03 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 - 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.04 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to

terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. Direct Furring:
 1. Screw to wood framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Furring Members:
 1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.05 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 3. Do not attach hangers to steel roof deck.
 4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 6. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
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SECTION 09 29 00 - GYPSUM BOARD

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.
 - 3. Shaft Wall
- B. Related Sections include the following:
 - 1. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
 - 2. Division 09 Section "Interior Painting" for primers applied to gypsum board surfaces.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. VOC Data:
 - 1. Product Data for Credit IEQ 4.1: For adhesives used to laminate gypsum board panels to substrates, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit IEQ 4: For adhesives used to laminate gypsum board panels to substrates, 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."

1.04 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack boards flat and supported on risers on a flat platform to prevent sagging.

1.05 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum board until installation areas are enclosed and conditioned.
- C. Do not install boards that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that boards are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that boards are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

- C. Low Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying 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."

2.02 INTERIOR GYPSUM BOARD

- 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 Gypsum.
 2. CertainTeed Corp.
 3. Georgia-Pacific Gypsum LLC.
 4. Lafarge North America Inc.
 5. National Gypsum Company.
 6. PABCO Gypsum.
 7. Temple-Inland.
 8. USG Corporation.
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- D. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
1. Thickness: 1/4 inch.
 2. Long Edges: Tapered.
- E. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- F. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.03 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Gypsum; Firebloc Type C.
 - b. CertainTeed Corp.; ProRoc Type C.
 - c. Georgia-Pacific Gypsum LLC; Fireguard C.
 - d. Lafarge North America Inc.; Firecheck Type C.
 - e. National Gypsum Company; Gold Bond Fire-Shield C.
 - f. PABCO Gypsum; Flame Curb Type Super C.
 - g. Temple-Inland; Type TG-C.
 - h. USG Corporation; Firecode C Core.
 2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
 3. Long Edges: Tapered.

2.04 GYPSUM BOARD FOR SHAFTWALL ASSEMBLIES

- A. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Gypsum; Shaft Liner.
 - b. CertainTeed Corp.; ProRoc Shaftliner.
 - c. Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; ToughRock Fireguard Shaftliner.
 - d. Lafarge North America, Inc.; Firecheck Type X Shaftliner.
 - e. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner.
 - f. PABCO Gypsum; Pabcore Shaftliner Type X.
 - g. Temple-Inland Inc.; Fire-Rated SilentGuard Gypsum Shaftliner System.
 - h. USG Corporation; Sheetrock Brand Gypsum Liner Panel.
 - 2. Thickness: 1 inch.
 - 3. Long Edges: Double bevel.
- B. Gypsum Shaftliner Board, Moisture- and Mold-Resistant Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with moisture- and mold-resistant core and surfaces.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; ProRoc Moisture and Mold Resistant Shaftliner.
 - b. Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; Dens-Glass Ultra Shaftliner.
 - c. Lafarge North America, Inc.; Firecheck Moldcheck Type X Shaftliner.
 - d. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner XP.
 - e. PABCO Gypsum; Pabcore Mold Curb Shaftliner Type X.
 - f. Temple-Inland Inc.; Fire-Rated SilentGuard TS Mold-Resistant Gypsum Shaftliner System.
 - g. USG Corporation; Sheetrock Brand Mold Tough Gypsum Liner Panel.
 - 2. Thickness: 1 inch.
 - 3. Long Edges: Double bevel.
 - 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.05 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; GlasRoc Tile Backer.
 - b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
 - 2. Core: 5/8 inch, Type X.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. C-Cure; C-Cure Board 990.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. National Gypsum Company, Permabase Cement Board.
 - d. USG Corporation; DUROCK Cement Board.
 - 2. Thickness: 5/8 inch.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.06 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.

2.07 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled board edges, and damaged surface areas, use setting-type taping compound.
 - a. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
 - b. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 - c. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 - d. Skim Coat: For final coat of Level 5 finish, use one of the following:
 - 1) Setting-type, sandable topping compound.
 - 2) High-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Tile Backing boards:
 - 1. Glass-Mat, Water-Resistant Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.08 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Laminating 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. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing).
- E. Acoustical Joint Sealant: As specified in Division 07 Section "Joint Sealants."

PART 3 EXECUTION

3.01 EXAMINATION

- A. Notify Owner prior to concealing insulation. Owner's third-party energy rater will conduct a pre-drywall thermal bypass inspection.
 - 1. Allow time to correct insulation deficiencies noted by the Owner's inspector prior to installation of gypsum board.
- B. Examine areas and substrates, with Installer present, and including welded hollow metal frames and framing, for compliance with requirements and other conditions affecting performance.

- C. Examine boards before installation. Reject boards that are wet, moisture damaged, and mold damaged.
- D. Remove and replace rusted trim.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLYING AND FINISHING PANELS

- A. Comply with ASTM C 840.
- B. Install ceiling boards across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent boards not less than one framing member.
- C. Install boards with face side out. Butt boards together for a light contact at edges and ends with not more than 1/16 inch of open space between boards. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum board.
- F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- G. Fit gypsum board around ducts, pipes, and conduits.
- H. Attachment to Steel Framing: Attach boards so leading edge or end of each board is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated and Sound-Improved Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum board, unless blankets are readily installed after boards have been installed on one side.
- K. Prefill open joints and damaged surface areas.
- L. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- M. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 0: Taping, finishing, and cornerbeads are not required.
 - 2. Level 1: At joints and interior angles, embed tape in joint compound. Board surfaces shall be free of excess joint compound, but tool marks and ridges are acceptable.
 - a. Application Areas: Concealed areas of fire-resistance-rated assemblies and sound-rated assemblies, and ceiling plenum areas.
 - 3. Level 2: At joints and interior angles, embed tape in joint compound and immediately apply joint compound over tape. Apply one coat of joint compound on fastener heads, and flanges of trim accessories. Board surfaces shall be free of excess joint compound, but tool marks and ridges are acceptable.
 - a. Application Areas: Boards that are substrate for hard tile.
 - 4. Level 4: At joints and interior angles, embed the tape in the joint compound and immediately apply joint compound over the tape. Apply two additional separate coats of the

joint compound over flat joints. Apply one additional coat of the joint compound over interior angles. Apply three separate coats of the joint compound over fastener heads and flanges of trim accessories. Board surfaces and the joint compound shall be smooth and free of tool marks and ridges.

- a. Application Areas: At board surfaces that will be exposed to view unless otherwise indicated.
 - 1) Critical (severe) lighting is as defined in GA-214.
 - b. Primer and its application to surfaces are specified in Division 09 Section "Painting." Level 4 is suitable for surfaces receiving paint finishes with gloss levels 1-4 (flat, velvet, eggshell, and satin) and other surfaces not subject to severe lighting.
5. Level 5: Finish shall be equal to Level 4 plus a skim coat over the entire gypsum board surface. Surfaces shall be smooth and free of tool marks and ridges.
- a. Application Areas: Surfaces receiving gloss and semigloss enamels and surfaces subject to severe angular lighting.
 - 1) Critical (severe) lighting is as defined in GA-214.
 - b. Primer and its application to surfaces are specified in Division 09 Section "Painting." Level 5 is suitable for surfaces receiving paint finishes with gloss levels 5-7 (semi-gloss, gloss, and high gloss) and other surfaces subject to severe lighting.

3.03 APPLYING GYPSUM BOARD FOR SHAFT-WALLS

- A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
 1. Division 09 Section "Non-Structural Metal Framing" for installing steel framing.
- B. Seal gypsum board shaft walls with acoustical sealant as required to maintain fire rating at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with ASTM C 919 requirements or with manufacturer's written instructions, whichever are more stringent.
- C. Cants: At projections into shaft exceeding 4 inches, install 1/2- or 5/8-inch- thick gypsum board cants covering tops of projections.
 1. Slope cants at least 75 degrees from horizontal. Set base edge of cants in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
 2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.
- D. Isolate perimeter of gypsum board from building structure to prevent cracking of boards, while maintaining continuity of fire-rated construction.

3.04 APPLYING TILE BACKING BOARDS

- A. Glass-Mat, Water-Resistant Backing board: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4- inch gap where boards abut other construction or penetrations.
- B. Where tile backing boards abut other types of boards in same plane, shim surfaces to produce a uniform plane across board surfaces.

3.05 INSTALLING TRIM ACCESSORIES

- A. Metal Trim: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for boards. Otherwise, attach trim according to manufacturer's written instructions.
 1. Aluminum Trim: Install in locations indicated on Drawings.
- B. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840 as follows. If joint locations are not indicated, obtain Architect's approval for visual effect.

1. Partition, wall, and wall furring runs in an uninterrupted straight plane exceeding 30 feet in length and total area between control joints does not exceed 900 sq ft:
 - a. At maximum 30 foot spacing. Where conditions permit, install required joints in the following locations:
 - 1) Extending up from one side of door openings.
 - 2) Extending up and down from sides of window openings.
 - b. Over and in line with construction joints (expansion, seismic, or building control element) in the base building structure.
 - c. Where partitions of dissimilar construction meet and remain in the same plane.
 - d. Wall or partition height door frames will be considered as acting as a control joint.
 - e. At fire-resistance rated walls, install gypsum backing behind joints per GA-234.
2. Ceilings:
 - a. Interior Ceilings With Perimeter Relief: Install control joints so that linear dimensions between control joints does not exceed 50 feet and total area between control joints does not exceed 2500 sq ft.
 - b. Interior Ceilings Without Perimeter Relief: Install control joints so that linear dimensions between control joints does not exceed 30 feet and total area between control joints does not exceed 900 sq ft.
 - c. Where conditions permit, install required joints in the following locations:
 - 1) At column penetrations.
 - 2) At large light fixture penetrations and similar stress locations.
 - d. Install control joints where ceiling framing or furring changes direction.
 - e. Install control joints where ceilings of dissimilar construction meet and remain in the same plane.
 - f. Install control joints where wings of "L" "U" and "T" shaped ceiling areas join.
 - g. Install control joints where indicated as a design element or feature
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners, unless otherwise indicated.
 2. LC-Bead: Use at exposed board edges in visible locations.
 3. L-Bead: Use at exposed board edges in visible locations where LC-Bead cannot be used.
 4. U-Bead: Use at exposed board edges in non-visible locations and where indicated.

3.06 PROTECTION

- A. Protect adjacent surfaces from drywall compound and texture finishes and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
- C. Remove and replace interior trim that rusts through joint compound.

END OF SECTION 09 29 00

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 09 30 13 - CERAMIC TILING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Porcelain tile
 - 2. Waterproof membrane for thinset applications.
 - 3. Crack isolation membrane.
 - 4. Grout
 - 5. Metal edge strips.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples:
 - 1. Each type and composition of tile and for each color and finish required.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units installed for each type, composition, color, pattern, and size indicated.
 - a. Provide One (1) unopened box of each type and color of tile to Owner during project closeout.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
 - 2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
 - 3. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.08 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 PRODUCTS

2.01 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.02 TILE PRODUCTS

- A. Ceramic Tile Type CT-1, CT-2, CT-3 and CT-4: Unglazed porcelain tile.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide "Shades" Style by Crossville or comparable product approved by architect.
 - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
 - 3. Face Size: As indicated in Material Index.
 - 4. Face Size Variation: Rectified.
 - 5. Thickness: 10.5 mm.
 - 6. Face: As indicated.
 - 7. Dynamic Coefficient of Friction: Not less than 0.42.
 - 8. Tile Color, Glaze, and Pattern: As indicated in Material Index.
 - 9. Grout Color: As indicated on Material Index.
- B. Ceramic Tile Type CT-5: ceramic wall tile
 - 1. Basis of Design Product: Subject to compliance with requirements, provide "Handwritten" Style by Crossville or comparable product approved by architect.
 - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
 - 3. Face Size: As indicated in Material Index.
 - 4. Face Size Variation: Rectified.
 - 5. Face: As indicated.
 - 6. Tile Color, Glaze, and Pattern: As indicated in Material Index.
 - 7. Grout Color: As indicated on Material Index.
- C. WATERPROOFING AND CRACK ISOLATION MEMBRANE
 - 1. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 - 2. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
 - 3. Products: Subject to compliance with requirements, provide one of the following :
 - a. Bostik, Inc.; Durabond D-222 Duraguard Membrane or Hydroment Gold.
 - b. C-Cure; Pro-Red Waterproofing Membrane 963.
 - c. Custom Building Products; Redgard Waterproofing and Crack Prevention Membrane.
 - d. Mer-Kote Products, Inc.; Fracture-Guard 5000.
 - e. Southern Grouts & Mortars, Inc.; Southcrete 1100 Crack Suppression and Waterproofing.
 - f. TEC; a subsidiary of H. B. Fuller Company; HydraFlex - Waterproofing Crack Isolation Membrane.

2.03 SETTING MATERIALS

- A. Latex-Portland Cement Mortar (Thin-Set): ANSI A118.4.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
 - a. Bostik, Inc.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.

- d. MAPEI Corporation.
 - e. TEC; a subsidiary of H. B. Fuller Company.
- 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
- 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- B. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
 - a. Bostik, Inc.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
 - e. TEC; a subsidiary of H. B. Fuller Company.
 - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

2.04 GROUT MATERIALS

- A. Grout Colors: As scheduled or, if not scheduled, as selected by Architect from full range
- B. High-Performance Tile Grout: ANSI A118.7.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide colored grout as indicated in finish schedule or comparable product by one of the following:
 - a. Bostik, Inc.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
 - e. TEC; a subsidiary of H. B. Fuller Company.
 - 2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
 - a. Provide unsanded grout mixture for wall joints and floor joints 1/8 inch and narrower.
 - b. Provide sanded grout mixture for floor joints wider than 1/8 inch.

2.05 ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with applicable requirements in Division 07 Section "Joint Sealants."
 - 1. Provide material as recommended by manufacturer, where new tile flooring abuts existing terrazzo material in Lobby - Stair B area.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated

2.06 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge and Transition Strips: Metal strips with integral perforated anchoring leg for anchorage to mortar bed or substrate; height to match tile and setting bed thickness.
 - 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. Ceramic Tool Company, Inc.
 - b. Futura Industries.
 - c. National Metal Shapes, Inc. Aluminum L-Shape Profiles.

- d. Schlüter® Systems
- 2. Material:
 - a. Extruded aluminum with clear anodic finish, Class II, AA-M12C22A31 finish.
 - b. UV-Resistant Pre-colored Rigid PVC profile with aluminum anchoring leg
- 3. Basis-of-Design Product for Floor Edge (TS-1, TS-2, TS-3): Schiene, Deco, Reno-U by Schlüter® Systems.
- 4. Basis of Design Product for Cove Strips (TS-4): Dilex-AHK by Schlüter® Systems
 - a. Color: As indicated on Material Index
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- D. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik, Inc.; Grout & Tile Sealer.
 - b. Custom Building Products; Grout and Tile Sealer.
 - c. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
 - d. TEC; a subsidiary of H. B. Fuller Company; Grout Sealer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.03 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors consisting of tiles 8 by 8 inches or larger.
 - c. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Porcelain and Ceramic Tile: 1/8 inch (6.35 mm) wall and floor application.
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them
 - 2. At Existing Stair B Lobby, where new tile flooring abuts existing terrazzo material, provide caulking material at joint(s) as recommended by manufacturer.
- J. Metal Edge Strips:
 - 1. Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
 - 2. Install where exposed edge of linoleum tile flooring meets carpet.
 - a. Provide Schluter Systems Kerdi-Fix bonding compound to anchor metal edge strip to substrate.
- K. Grout Sealer: Apply grout sealer to grout joints in all tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- L. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.
- M. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

- N. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

3.04 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Concrete Subfloor, Thin-Set:
1. Thin-set mortar on waterproof membrane: TCA Method F122.
 - a. Thin-Set Mortar: Medium-bed, latex-portland cement mortar for large format tile, latex-portland cement mortar elsewhere.
 - b. Grout: Polymer-modified grout.
 2. Thin-set mortar on crack isolation membrane: TCA Method F125A.
 - a. Thin-Set Mortar: Medium-bed, latex-portland cement mortar for large format tile, latex-portland cement mortar elsewhere.
 - b. Grout: Polymer-modified grout.
- B. Interior Wall Installations, Masonry or Concrete, Thin Set:
1. Thin-set mortar: TCA Method W202.
 - a. Thin-Set Mortar: Medium-bed, latex-portland cement mortar for large format tile, latex-portland cement mortar elsewhere .
 - b. Grout: Polymer-modified grout
- C. Interior Wall Installations, Plaster/Gypsum Board on Wood or Metal Studs or Furring, Thin Set:
1. Thin-set mortar on coated glass-mat, water-resistant gypsum backer board: TCA Method W245.
 - a. Thin-Set Mortar: Latex- portland cement mortar.
 - b. Grout: Polymer-modified grout.
- D. Other Locations:
1. Movement Joints: At expansion, construction, contraction, isolation/expansion, perimeter, and generic movement joints: TCA Method EJ171.
 - a. Sealant fill joints aligned directly over sawed or tooled concrete slab contraction joints complying with requirements in Division 07 Section "Joint Sealants."

END OF SECTION 09 30 13

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes acoustical panels, exposed suspension systems and perimeter trim systems for ceilings.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed finish.
- C. Maintenance data.

1.04 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory.
- B. Fire-Test-Response Characteristics:
 - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 2. Surface-Burning Characteristics: Acoustical panels complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84.

1.05 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 10.0 percent of quantity installed.
 - 2. Suspension System Components: Quantity of each exposed component equal to 10.0 percent of quantity installed.

PART 2 PRODUCTS

2.01 ACOUSTICAL PANEL CEILINGS, GENERAL

- A. Acoustical Panel Standard: Comply with ASTM E 1264.
- B. Metal Suspension System Standard: Comply with ASTM C 635.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Expansion anchors fabricated from corrosion-resistant materials, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.
- E. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.02 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING (APC-1, APC-2, APC-3)

- A. Products: Subject to compliance with requirements, provide one of the following:
 1. Armstrong World Industries, Inc.
 - a. Ultima Beveled Tegular, HRC, fine texture
 2. USG Interiors, Inc.
 3. Architect Approved Equal
- B. Classification: Fire Class A, Type: IV, Form 2, Pattern E
- C. Material: Wet-formed mineral fiber with DuraBrite® membrane Color: White.
- D. NRC: 0.70
- E. CAC: 35
- F. Light Reflectance: 0.90
- G. Edge/ Joint Detail: Beveled Tegular
- H. Modular Size: 24 inch x 24 inch
- I. Thickness: 3/4-inches

2.03 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING (WITH APC-1, APC-2, APC-3).

- A. Products: Subject to compliance with requirements, provide one of the following:
 1. Armstrong World Industries, Inc.
 - a. Prelude XL HRC (15/16" suspension system)
 2. USG Interiors, Inc.
 3. Architect Approved Equal
- B. Double-Web Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30(Z90) coating designation, with prefinished 15/16 inch wide metal caps on flanges.
 1. Structural Classification: Intermediate duty system
 2. Face Design: Flat, Flush
 3. Cap Material: Steel
 4. Cap Finish: Painted white

2.04 METAL PERIMETER TRIM (APC-1, APC-2, APC-3)

- A. Products: Subject to compliance with requirements, provide one of the following:
 1. Armstrong World Industries, Inc.
 - a. Axiom - Classic Trim System for use at exposed perimeter edges with APC-1
 - b. Axiom - Knife Edge Trim System for use at exposed perimeter edges with APC-2
 2. USG Interiors, Inc.
 3. Architect Approved Equal
- B. Color: Flat White
- C. Material: Factory Painted Extruded Aluminum alloy trim with unfinished aluminum Tee Bar connection clips, hanging clips and splice plates.
- D. Trim Profile:

1. Axiom- Classic, Straight, 4 inch nominal height (3 7/8 inch x 3/4 inch wide)
2. Axiom - Knife Edge, 2 5/16 inch height x 5 9/16 inch wide
 - a. Axiom - Knife Edge Trim System to use factory corners where required

PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
- B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders.
- C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 1. Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.
 2. Do not attach hangers to steel deck tabs.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

END OF SECTION 09 51 13

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 09 54 36 - SUSPENDED DECORATIVE CEILINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes unperforated laminate/ metal ceiling panels, suspended grids and suspension systems for ceiling application.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Coordination Drawings:
 - 1. Reflected ceiling plan including joint patterns, ceiling mounted items and details.
 - 2. Special moldings at walls, column penetrations and other junctures of decorative ceiling with adjoining construction.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.05 QUALITY ASSURANCE

- A. Installer: certify a minimum of 5 years experience installing similar systems and scope as required for this project.
- B. Provide a list of at least 5 successful installations with similar products and scope. Include names and contact numbers of Architect and employer for reference.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.

2.02 SUSPENDED DECORATIVE CEILINGS, GENERAL

- A. Sheet Metal Characteristics: Provide sheet metal selected for surface flatness, smoothness, and freedom from surface blemishes where exposed to view in finished unit. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled metal sheet, stains, discolorations, or other imperfections.
 - 1. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B 209 (ASTM B 209M); alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - a. Bonded Finishes: Saranté PVC free, laminate that is permanently bonded to the aluminum sheet with formaldehyde free, water based adhesive of minimum bond strength of 425psi@25 degrees C.
- B. Grid Fabrication: Components are formed from metal indicated. Manufacturer's standard units of size, shape, and profile indicated; finished to comply with requirements indicated.
- C. Cover Profiles and Trim: Provide manufacturer's standard cover profiles and trim for exposed members, and as indicated or required, for edges of grids, at changes in ceiling height, and for other conditions, of same metal and finish as suspended decorative grids.
- D. Metal Suspension-System Standard: Comply with ASTM C 635/C 635M.

- E. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635/C 635M, Table 1, Direct Hung, unless otherwise indicated.

2.03 SUSPENDED DECORATIVE CEILING (DCP-1):

- A. Manufacturers:
 - 1. Ceilings Plus
 - 2. Hunter Douglas
 - 3. Architect Approved Equal
- B. Suspended Decorative Ceiling (DCP-1): Manufacturer's standard aluminum panel construction with PVC free laminate face finish and suspension system.
 - 1. Basis of Design: Illusions™, Saranté
 - a. Ceilings Plus®
 - b. 6711 East Washington Boulevard
 - c. Los Angeles, CA 90040
 - d. Ph: 800-822-3411
 - e. www.ceilingplus.com
- C. Panels: Die formed with a minimum 1 ¼ inch integral return edge on each of the four panel sides. Steel clips locate and align panels to suspension grid with torsion springs
 - 1. Fasteners shall not be visible on exposed face surfaces of panels or support tees.
- D. Panel Size: As indicated on drawings A.2 Series
- E. Panel Edge: Square, butt joint condition with concealed tee.
- F. Profile Trim: 4 ½ inch in height. Provide matching finish trim at exposed faces on all sides of suspended area.
- G. Finish: Saranté PVC laminate to exposed face and edge.
- H. Color: As indicated on Material Index

2.04 METAL SUSPENSION SYSTEM - GENERAL:

- A. Metal Suspension Standard: Provide panel manufacturer's metal suspension system of types, structural classifications, materials and finishes indicated that comply with applicable ASTM C635 requirements.
- B. Provide complete suspension systems with main runners, cross runners, hangers, trim molding, seismic retention clips, load resisting struts and other suspension components required to support ceiling and other ceiling supported construction.
- C. Double-Web Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30(Z90) coating designation, with prefinished metal caps on flanges.
 - 1. Structural Classification: Heavy duty system
 - 2. Face Design: Main runners to be factory slotted to receive torsion springs
 - 3. Cap Material: Steel
 - 4. Cap Finish: Factory finished matte black unless noted otherwise
- D. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, :Direct Hung, unless otherwise indicated.
 - 1. Provide anchor for use in particular application
 - 2. Anchors must provide corrosion resistance as per metal type and application.
- E. Direct Hung Suspension Systems: System composed of main runners supported by hangers attached directly into building structure.
- F. Indirect Hung Suspension Systems: Systems composed of main runners connected to carrying channels that are attached by hangers to building structure and complying with the following requirements:

1. Hangers: Type and metal standard with ceiling system manufacturer, sized to comply with structural classification indicated.
2. Wire Hangers, Braces and Ties: Provide wires complying with the following requirements:
 - a. Zinc-Coated Carbon Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
 - b. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635) will be less than yield stress of wire, but provide not less than 2mm diameter wire.
 - c. Extruded Aluminum members shall comply with ASTM B209.
 - d. Hanger Rods: Mild steel, zinc coated or protected with rust inhibitive paint.
 - e. Flat Hangers: Angles with legs not less than 22mm wide, formed with 1mm thick, galvanized steel sheet complying with ASTM A 653/A, G90 coating designation, with bolted connections.

2.05 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Surface preparation of aluminum surfaces to include cleaning and pre-testing of surface to comply with MMA 620-02, Voluntary Specifications for High Performance Organic Coatings on Coil Coated Aluminum Substrates.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.06 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
- B. Clear Mirror Anodic Finish: AA-M21C12A212, Class II, 0.005 mm or thicker.
- C. Color-Coated Finish: Manufacturer's standard baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
- D. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness.

2.07 METALLIC-COATED STEEL SHEET FINISHES

- A. Color-Coated Finish: Manufacturer's standard baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

2.08 STEEL SHEET FINISHES

- A. Electroplated Finish: Electroplating process complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, and minimum thickness.
- B. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Install suspended decorative ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
- B. Install suspended decorative ceilings in coordination with suspension system and exposed moldings and trim. Comply with installation tolerances according to Cisca's "Metal Ceilings Technical Guidelines."

- C. Install edge moldings and trim at perimeter of ceiling area and where necessary to conceal edges of decorative ceiling panels. Method of edge trim attachment and design of edge trims to be approved by Architect.
 - 1. Screw attach moldings to substrate at intervals not more than 18 inch on center and not more than 6 inch from ends, levelling with ceiling suspension system to a tolerance of 1/8 inch in 10 foot. Miter corners accurately and connect securely.
 - 2. Don not use exposed fasteners, including pop rivets on moldings and trim without prior written approval from Architect.
- D. Scribe and cut decorative metal panel units for accurate fit at penetrations of other work or trades through ceiling. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
- E. Install metal panel units in coordination with suspension system.
- F. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions, unless otherwise indicated. Install directionally patterned or textured panels in directions indicated on approved shop drawings. Panel joints shall flow smoothly and in a straight line. Intersections shall be continuous.
- G. Remove panels from protective packaging only when space is completely clean and free of airborne particles. Use methods of installing unprotected panels as written and recommended by manufacturer.

3.02 ADJUSTING AND CLEANING:

- A. Adjust ceiling components to provide a consistent finish and appearance in conformity with established tolerances and requirements.
- B. Remove and replace Work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 09 54 36

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

1.04 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.05 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Install resilient products after other finishing operations, including painting, have been completed.

1.06 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Resilient Base: Full Coils or lengths equal to 10.0 percent of quantity installed or each color and type.

PART 2 PRODUCTS

2.01 RESILIENT BASE (RB-1)

- A. Resilient Base:
 - 1. Manufacturers: Design Standard: Johnsonite Traditional Wall Base.
 - 2. 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. Armstrong World Industries, Inc.
 - b. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
 - c. Johnsonite.
 - d. Roppe Corporation, USA.
- B. Resilient Base Standard: ASTM F 1861.
 - 1. Material Requirement: Type TP (rubber, thermoplastic)
 - 2. Manufacturing Method: Group I (solid, homogeneous)
 - 3. Style: Cove (base with toe)
- C. Minimum Thickness: 0.125 inch (3.2 mm).
- D. Height: 4 inch (10.16 cm).

- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed
- G. Inside Corners: Job formed
- H. Finish: Matte
- I. Colors and Patterns: As indicated in Material Index.

2.02 RESILIENT BASE (RB-2)

- A. Resilient Base:
 - 1. Manufacturers: Design Standard: Johnsonite Millwork Wall Base.
 - 2. 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. Armstrong World Industries, Inc.
 - b. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
 - c. Johnsonite.
 - d. Roppe Corporation, USA.
- B. Resilient Base Standard: ASTM F 1861.
 - 1. Material Requirement: Type TP (rubber, thermoplastic)
 - 2. Manufacturing Method: Group I (solid, homogeneous)
 - 3. Style: Cove (base with toe)
- C. Minimum Thickness: 0.25 inch (6.35 mm).
- D. Height: 4 ¼ inch (10.8 cm).
- E. Lengths: Manufacturers standard 8 ft lengths.
- F. Outside Corners: Job formed
- G. Inside Corners: Job formed
- H. Finish: Matte
- I. Colors and Patterns: As indicated in Material Index.

2.03 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)
 - 2. Adhesives 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."

PART 3 EXECUTION

3.01 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Accessories: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.

4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed.
 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.02 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces where indicated, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Install resilient base at outside corners as required to not expose gaps in the adjacent flooring.

3.03 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
- C. Cover resilient products until Substantial Completion.

END OF SECTION 09 65 13

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Vinyl composition floor tile.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.05 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. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed to be delivered to Owner during project closeout.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.02 VINYL COMPOSITION FLOOR TILE (VCT-1)

- A. Manufacturer: Armstrong World Industries
 1. P.O. Box 3001
 2. Lancaster PA, 17603
 3. Ph: 800- 866-5638
 4. www.armstrong.com
- B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.
- C. Wearing Surface: Smooth.
- D. Thickness: 0.125 inch (3.2 mm).
- E. Size: 12 by 12 inches (305 by 305 mm).
- F. Colors and Patterns: As selected by Architect from full range of industry colors and as indicated in the Material Index.

2.03 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
 1. Adhesives shall comply with the following limits for VOC content:
 - a. Vinyl Composition Tile Adhesives: 50 g/L or less.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

- b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.03 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain running in one direction.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings. Consult Architect where tiles less than 1 inch wide would be installed at door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.04 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply three coat(s).

E. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 65 43 - LINOLEUM FLOORING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes linoleum floor tile.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (152-by-230-mm) sections of each different color and pattern of linoleum flooring required.
- C. Product Schedule: For linoleum flooring. Use same designations indicated on Drawings.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of linoleum flooring to include in maintenance manuals.

1.05 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. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed, to be delivered to Owner during project closeout.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 90 deg F (32 deg C).
 - 1. Floor Tile: Store on flat surfaces.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive flooring during the following time periods:
 - 1. 72 hours before installation.
 - 2. During installation.
 - 3. 72 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during flooring installation.
- D. Close spaces to traffic for 72 hours after flooring installation.
- E. Install flooring after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For linoleum flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. FloorScore Compliance: Flooring shall comply with requirements of FloorScore certification.

- C. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.02 LINOLEUM FLOOR TILE (LIN-1, LIN-2, LIN-3, LIN-4, LIN-5)

- A. Manufacturer: Forbo Flooring Systems
 - 1. Humbolt Industrial Park
 - 2. Hazelton, PA 18202
 - 3. Ph: 1-800-842-7839
 - 4. www.forboflooringna.com,
- B. Linoleum Floor Tile: ASTM F 2195, Type I, linoleum floor tile with fibrous backing.
 - 1. Nominal Floor Tile Size: 13 by 13 inches (330 by 330 mm).
- C. Thickness: 0.08 inch (2.0 mm).
- D. Colors and Patterns: As selected by Architect from full range of industry colors and indicated in Material Index, Room Finish Schedule and Finish Plans.

2.03 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by linoleum flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit products and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50g/L or less.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by linoleum flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to linoleum flooring manufacturer's written instructions to ensure adhesion of flooring.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by linoleum flooring manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by linoleum flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Perform tests recommended by linoleum flooring manufacturer, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

- b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install flooring until it is the same temperature as space where it is to be installed.
 - 1. At least 72 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.

3.03 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions for installing flooring.
- B. Scribe and cut flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings. Consult Architect where 1 inch or less wide floor tiles could be installed at door openings.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- E. Install flooring on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
- F. Adhere flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.04 LINOLEUM FLOOR TILE INSTALLATION

- A. Lay out linoleum floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay floor tiles square with room axis and in pattern indicated.
- B. Match linoleum floor tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.
 - 1. Lay floor tiles with grain running in one direction in pattern of colors and sizes indicated.

3.05 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting linoleum flooring.
- B. Perform the following operations immediately after completing linoleum flooring installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect linoleum flooring from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from linoleum flooring before applying liquid floor polish.
 - 1. Apply three coat(s).

- E. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover linoleum flooring until Substantial Completion.

END OF SECTION 09 65 43

SECTION 09 68 13 - TILE CARPETING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes modular, Tufted Textured Pattern Loop carpet tile and Needle-punch Hair Tile.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Type of installation.
 - 3. Pattern type, location, and direction.
- C. Samples: For each exposed product and for each color and texture specified.

1.04 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranty.

1.05 EXTRA MATERIALS

- A. Furnish extra materials to owner, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver to owner during project closeout.
 - 1. Carpet Tile: Full Size tiles equal to 10.0 percent of quantity installed.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.09 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of tuft bind strength, loss of face fiber, and delamination.
 - 3. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 CARPET TILE (CPT-1)

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Manufacturer: Mannington Commercial
- B. Pattern: Stock Brights
- C. Color: Custom Color - As indicated on the Material Index
- D. Size: 24 inches x 24 inches (610 by 610 mm)
- E. Installation Method: Brick Ashlar
- F. Face Fiber: Invista Antron Lumena Type 6,6 Four Hole, Hollow Filament Nylon with Permanent Stain and Bleach Protection, Static Control and Duratech Soil Resistant Treatment and a fiber modification ration of <1.5.
- G. Dye Method: Solution Dye
- H. Gauge: 1/10
- I. Pile Thickness: .123 inches
- J. Primary Backing/Backcoating: 100% Synthetic
- K. Secondary Backing: Infinity Modular Reinforced Composite Closed Cell Polymer
- L. Radiant Panel (ASTM E 648): Class 1 (direct glue)
- M. Smoke Chamber (ASTM E 662): Less than 450
- N. Electrostatic Propensity (AATCC 134): Less than 3.0 KV

2.02 CARPET TILE (WOM-1)

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Manufacturer: Interface, Inc.
 - 2. Architect Approved Equal
- B. Pattern: FLOR
- C. Color: As indicated on the Material Index
- D. Size: 24 inches x 24 inches (610 by 610 mm)
- E. Installation Method: Quarter Turned
- F. Fiber: 55% Nylon, 27.5% Animal Hair, 17.5% Polyester.
- G. Pile Height: 0.16 inches
- H. Pile Thickness: .165 inches
- I. Primary Backing/Backcoating: Graphlar®
- J. Radiant Panel (ASTM E 648): Class 1
- K. Smoke Chamber (ASTM E 662): Less than or equal to 450

2.03 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Transition Strips (Carpet to Tile): Satin anodized aluminum profile with sloped exposed surface, 5/32 inch tall leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 1. Basis-of-design Product: Schluter Reno-U.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Preparation: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- E. Installation: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- F. Installation Method: Glue Down; Install every tile with full-spread, releasable, pressure sensitive adhesive.
- G. Maintain dye lot integrity. Do not mix dye lots in same area.
- H. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- I. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- J. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- K. Install pattern parallel to walls and borders.
- L. Perform the following operations immediately after installing carpet tile:
 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 2. Remove yarns that protrude from carpet tile surface.
 3. Vacuum carpet tile using commercial machine with face-beater element.
- M. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

3.02 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 2. Remove yarns that protrude from carpet tile surface.
 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 72 00 - WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall covering and borders.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 23 - Interior Painting: Preparation and priming of substrate surfaces.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- B. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2015.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall covering and adhesive.
- C. Shop Drawings: Indicate wall elevations with seaming layout.
- D. Product Schedule: For all wall coverings using same designations indicated on drawings.
- E. Samples: Submit two samples of wall covering, full width by 36 inch in size illustrating color, finish, and texture.
- F. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.
- G. Manufacturer's Installation Instructions: Indicate special procedures.
- H. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Wall Covering Materials: 25 linear feet of each color and pattern of wall covering; store where directed.
 - 3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inspect roll materials at arrival on site, to verify acceptability.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.
- C. Do not store roll goods on end.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
- B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surfaces.

PART 2 PRODUCTS

2.01 WALL COVERINGS

- A. General Requirements:
 - 1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
- B. Wall Covering: Vinyl roll stock, conforming to the following:
 - 1. Conform to ASTM F793/F793M, Category V, Type II.
 - 2. Color: As indicated on Drawings.
 - 3. Pattern: As indicated on Drawings.
 - 4. Surface Texture: As indicated on Drawings.
- C. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.
- D. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are prime painted and ready to receive work, and conform to requirements of the wall covering manufacturer.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.

3.02 PREPARATION

- A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
- B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
- C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.
- E. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall surface immediately prior to application of wall covering.
- C. Use wall covering in roll number sequence.
- D. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.
- E. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- F. Horizontal seams are not acceptable.
- G. Do not seam within 2 inches of internal corners or within 6 inches of external corners.
- H. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.
- I. Do not install wall covering more than 1/4 inch below top of resilient base.
- J. Cover spaces above and below windows, above doors, in pattern sequence from roll.

- K. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet.
Wipe clean with dry cloth.

3.04 CLEANING

- A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

- A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION 09 72 00

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 09 84 47 - MODULAR METAL WALL SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Non-perforated metal wall panels
 - 2. Suspension assemblies
 - 3. Accessories; provide other necessary items including devices for attachment overhead construction, secondary members, splines, splices, connecting clips, wall connectors, trims, and other devices required for a complete installation.

1.03 SUBMITTALS

- A. Product Data: Manufacturers product data for each type of product specified in this section.
- B. Product Certification: Manufacturer's certifications that products comply with specified requirements and governing codes including product data, laboratory test reports and research reports showing compliance with specified standards.
- C. Shop (Coordination) Drawings: Submit shop drawings for wall elevations, drawn to scale, and coordinating penetrations and wall mounted items. Show the following details:
 - 1. Wall elevation plan layout including joint patterns & details.
 - 2. Metal wall suspension system plan with appropriate components, suggested support locations & details.
 - 3. Method of attaching suspension system to building structure.
 - 4. Wall coordination with: light fixtures, air outlets and inlets, speakers, railings, and other interfaces.
 - 5. Special moldings at ceilings, rail attachments, and other junctures with adjoining construction.
 - 6. Framing and support details for work supported by wall suspension system.
- D. Samples for Verification: Full-size units (or as specified below) of each type of wall assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics. Submit samples for each type specified.
 - 1. 12-inch square, (acoustical) metal pan units.
 - 2. 12-inch long samples of each exposed molding or trim.
 - 3. 12-inch long samples of each suspension component.

1.04 QUALITY ASSURANCE

- A. Installer
 - 1. To certify a minimum 5 years' experience installing similar systems and scope to those specified.
 - 2. Provide list of at least 5 successful installations with similar products and scope. Include names and contact numbers of Architect and employer for reference.
- B. Manufacturer
 - 1. To certify a minimum of 5 years' experience manufacturing similar products to those specified.
 - 2. Provide support documentation including name and date of project completion. Include names and contact numbers of Architect and employers for reference.
 - 3. Manufacturer shall be single source and shall be the fabricator and supplier of appropriate major components.
- C. Fire-Test-Response Characteristics: Provide acoustical metal pan walls that comply with one of the following requirements:

1. Fire-response tests performed by UL, ITS/Warnock Hersey, or another independent testing and inspecting agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
2. Surface-burning characteristics of acoustical metal pans comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical metal wall units and suspension system components in original, unopened packages clearly labeled with the following information: name of manufacturing source and location; product type, description and quantity; clients name and shipping address.
- B. Panel's protective layer to be removed only after installation is complete to help prevent panel surface damage.
- C. Store components in a fully enclosed space where they will be protected against physical damage from direct moisture, significant change in humidity, direct sunlight, significant change in temperature, surface contamination, and any other preventable cause.
- D. Exercise care in handling components to prevent damage to the surfaces and edges and prevent distortion or other physical damage. Comply with prescribed stacking instructions to prevent damage to the components

1.06 PROJECT CONDITIONS

- A. Environmental Limitations
 1. Do not install acoustical metal pan walls until after spaces are enclosed and weather tight and after any wet work and work around walls is complete and accepted by project Architect.
 2. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits. Allow materials to reach ambient temperature and humidity for a minimum of 24 hours (48 hours recommended), prior to starting installation.
 3. Coordinate with other work supported by, adjacent to or penetrating through the wall system.

1.07 WARRANTY

- A. Provide specified manufacturers warranty against defects in workmanship, discoloration, or other defect considered undesirable by the Architect or Employer.
- B. This warranty shall remain in effect for a minimum period of five (5) years from date of initial acceptance.

1.08 MAINTENANCE & EXTRA MATERIALS

- A. Maintenance Instructions: Provide manufacturers standard maintenance and cleaning instructions for finishes provided.
- B. Extra Materials: Furnish to owner extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Only typical system components are included with attic stock. To be delivered to owner during project closeout.
 1. Acoustical Metal Wall Pan Units: Full-size units equal to 1-1/2 percent (1-1/2%) of amount installed.
 2. Suspension System Components: Quantity of each grid and exposed component equal to 1-1/2 percent (1-1/2%) of amount installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-design Product: Ceilings Plus - 6711 E. Washington Blvd., Los Angeles, CA 90040. 800-822-3411 - www.ceilingplus.com.
- B. Supply specified item or comply with Division 01 Section "Product Requirements." Specified manufacturer's standard of quality and manufacturing tolerances shall be the criteria for evaluating "equivalent" products. Substitution shall be equal to or of better quality than the specified product in the opinion of the Architect and / or owner.

2.02 MATERIALS (DWP-1, DWP-2, DWP-3, DWP-4)

- A. Ceilings Plus "Wallforms" - Perforated - Saranté® finish to match Architect's sample; or approved equal.
 - 1. Panels are to be manufactured from single sheets of aluminum selected for surface flatness, smoothness and freedom from surface blemishes where exposed to view in a finished unit. Do not use material where the exposed surface exhibit pitting, seam marks, roller marks, stains, discolorations, or variations in flatness exceeding those permitted by referenced standards for stretcher-leveled aluminum alloy sheets.
 - 2. Panels are to be die formed with a minimum 1-1/2-inch integral return edge on each of the four panel sides. Hooks to engage the panels into a factory engineered hat channel, shall be an integral part of the panel flange. No fasteners of any kind shall be visible on exposed face surfaces of ceiling panels or support tees. Wall penetrations shall be factory precision cut whenever viable.
 - 3. Panel material shall be primed aluminum sheet type 3105 (painted) / 5005 (anodized) series alloy that has a minimum 70% (50% @ 5005) recycled content. It shall be machine stretcher-leveled and a minimum of .032-inch thickness, or greater if required, so that the panel deflection does not exceed L/360.
 - 4. The panel finish shall be:
 - a. DWP-1: "Sarante" PVC free, faux wood veneer that is permanently bonded to the aluminum sheet with formaldehyde free, water based adhesive of minimum bond strength of 8 psi @ 25 degrees C.
 - b. DWP-2, DWP-3, DWP-4: provide factory applied powder coated finish that is permanently bonded to the aluminum sheet, of colors as selected by Architect and as indicated on the Material Index.
 - 5. Panel sizes as indicated on drawings. Field cut panels at non modular perimeter conditions, at column interfaces or as detailed or specified.
 - 6. Edge Profile: Panel joints are butt condition (concealed suspension) both directions unless specified otherwise.
 - 7. The plenum shall be 100% accessible. Every panel must be removable. Progressive panel access is not acceptable.
 - 8. Fire Tests: Complete system test including suspension, primed aluminum and finish shall meet ASTM E 84 Class A.
 - 9. Provide and install matching finish trim on each side of each area (or as specified).

2.03 METAL SUSPENSION SYSTEMS. GENERAL

- A. Metal Suspension Standard: Provide panel manufacturer's metal suspension systems of materials and finishes indicated.
 - 1. Hat channels to made of minimum 22 gage steel.
 - 2. Backer plates to made of minimum 18 gage steel.
 - 3. Face of hat channels and backer plates to be factory finished matte black unless known otherwise.
 - 4. Face of hat channels to be factory slotted to receive panel hooks.

5. Provide suspension system made from steel sheet with an average recycled content such that post consumer recycled content plus one half or pre consumer content is not less than 25 percent.
- B. Suspension Systems: Provide complete suspensions systems with vertical hat channels, backer plates, trim molding and other suspension components required to support wall and other wall supported construction.
- C. Attachment Devices: Size for five times design load, unless otherwise indicated (supplied by installer)
 1. Provide anchor, for use in the particular application, as approved by the "Structural Engineer of record."
 2. Structural substrate, as indicated to support attachment device, also to be approved by the "Structural Engineer of record."
 3. Anchors specified must provide corrosion resistance as per metal type and application.

2.04 METAL BASE (MTB-1)

2.05 FRY REGLET, REVEAL BASE TO BE USED AS INTEGRATED BASE WITH .DWP-1 AND MAIN LOBBY 130 RECEPTION DESK.

- A. Characteristics:
 1. Material: Extruded Aluminum
 2. Finish: Clear
 3. Dimension: MTB-1 to be 4 inch in height.
 4. Corners: Miter outside corners/ returns
 - a. Install: As recommended by Manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and structural framing to which acoustical metal panels attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect installation and anchorage, and other conditions affecting performance of metal panel walls.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other anchors whose installation is specified in other Sections.
- B. Measure each wall area and establish layout of acoustical metal pan units to balance border widths at opposite edges of each wall. Avoid using less-than-half-width units at borders, and comply with layout shown on elevation plan layouts.
- C. Survey substrate for wall attachment to assure squareness and proper elevation for wall panel installation.

3.03 INSTALLATION

- A. General: Install acoustical metal pan walls, per manufacturers shop drawings provided, per manufacturer's written instructions.
- B. Suspend hat channels and backer plates from building's approved structural substrates and as follows:
 1. Install hat channels and backer plates plumb and free from contact with insulation or other objects within wall system that are not structural support members
 2. Space hangers not more than 48 inches on center, along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches from ends of each member. Supply supporting calculations from licensed Structural

- Engineer verifying mount spacing meets all requirements, when spacings exceed those recommended.
3. Fine level suspension to 1/8 inch in 10 feet from specified elevation(s), square and true.
 4. Adjust suspension system runners so they are square (within .5 degree from 90 degrees) and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical wall areas and where necessary to conceal edges of acoustical metal pan. Method of edge trim attachment and design of edge trims to be approved by Architect.
1. Screw attach moldings to substrate at intervals not more than 18-inches O.C. and not more than 6-inches from ends, leveling with wall suspension system to a tolerance of 1/8-inch in 10-feet. Miter corners accurately and connect securely.
 2. Do not use exposed fasteners, including pop rivets, on moldings and trim without prior written approval. Or unless detailed otherwise.
- D. Scribe and cut metal panel units for accurate fit at penetrations by, other work through walls. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
- E. Install metal panel units in coordination with suspension system.
1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions, unless otherwise indicated. Install directionally patterned or textured panels in directions indicated on approved shop drawings. Panel-joints shall flow smoothly and in a straight line within 1/8-inch in 10-feet. Intersections shall be continuous.
 2. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating wall.
 3. Remove protective film from panels only when space is completely clean and free of airborne particles. Use method of installing unprotected panels into grid system as written and recommended by manufacturer.

3.04 ADJUSTING AND CLEANING

- A. Adjust wall components to provide a consistent finish and appearance in conformity with established tolerances and requirements.
- B. Clean exposed surfaces of acoustical metal panel walls. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 09 84 47

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
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SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Galvanized metal.
 - 5. Aluminum (not anodized or otherwise coated).
 - 6. Wood.
 - 7. Gypsum board.
 - 8. Plaster.
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
 - 3. Division 08 Sections for shop priming windows and doors with primers specified in this Section.
 - 4. Mechanical and Electrical Sections for additional painting requirements for items in equipment rooms and spaces.

1.03 DEFINITIONS

- A. MPI VOC "E" Ranges (grams/L)
 - 1. E3: Less than 51 g/l
 - 2. E2: 51 to 100 g/l
 - 3. E1: 101 to 200 g/l
 - 4. E0: Outside range (over 200 g/l)
 - 5. N/A: Unavailable
- B. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- F. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- H. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.
- I. Exposed Surfaces: Surfaces of products, assemblies, and components visible from any angle after final installation. Includes internal surfaces visible when operable doors, panels or drawers are open, and surfaces visible behind registers, grilles, or louvers.
- J. Concealed Surfaces: Surfaces permanently hidden from view in finished construction and which are only visible after removal or disassembly of part or all of product or assembly.

- K. Inaccessible Spaces: Spaces not intended for human use.
 - 1. Spaces listed below are defined as "Concealed" or "Inaccessible":
 - a. Space between suspended ceilings and floor or roof construction above.
 - b. Inside furred spaces.
 - c. Inside of partitions.
 - d. Mechanical and electrical items enclosed within casework or equipment.
 - e. Foundation spaces.
 - f. Crawl spaces.
 - g. Trenches and manholes.
 - h. Enclosed elevator shafts.
 - i. Mechanical shafts or chases.
- L. System DFT: Dry film thickness of entire coating system unless otherwise noted.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. VOC Data:
 - 1. Product Data for paints and coatings, including printed statement of VOC content.
 - 2. Laboratory Test Reports for paints and coatings, documentation indicating that they meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Samples for Color and Gloss Verification: For each finish and for each color required, prepare two samples of each opaque finish coating specified in each color and gloss scheduled for appearance verification. Resubmit until required gloss and color are achieved.
 - 1. Prepare on manufacturer's standard draw-down cards. Apply sufficient coating thickness to provide proper hiding and appearance.
 - 2. Label each sample to indicate material, color, and gloss.
- D. Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials to owner, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver to owner during project closeout.
 - 1. Paint: 10 percent, but not less than 1 gal. of each material and color applied.

1.06 QUALITY ASSURANCE

- A. 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 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - b. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 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.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Sherwin-Williams Company (The).
 - 2. Benjamin Moore & Co.
 - 3. PPG Architectural Finishes, Inc.
 - 4. Pratt & Lambert
 - 5. ICI
- B. Manufacturer Source Limitations:
 - 1. Obtain primary paint products through one source from a single manufacturer for entire Project, unless otherwise acceptable to Architect.
 - 2. Furnish secondary products and accessory materials only of type and from source recommended by manufacturer of primary paint products.

2.02 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
 - 1. If selected manufacture does not have an MPI evaluated product listed in the Paint Products Schedule, submit manufacturer's recommended alternate product for approval.
 - 2. All materials used shall be lead and mercury free and shall have low VOC content where possible.
 - 3. Use only materials having a minimum MPI "Environmentally Friendly" E2 or E3 rating based on VOC (EPA Method 24) content levels.
 - 4. At interior locations, use only MPI listed materials having an "L" rating designation.
- 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: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Dry-Fog Coatings: 400 g/L.
 - 4. Primers, Sealers, and Undercoaters: 200 g/L.

5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 7. Pretreatment Wash Primers: 420 g/L.
 8. Floor Coatings: 100 g/L.
 9. Shellacs, Clear: 730 g/L.
 10. Shellacs, Pigmented: 550 g/L.
- D. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Colors: As indicated in finish schedule.

2.03 ACCESSORIES

- A. Spackling Compound, Putty, Plastic Wood Filler, Liquid De-Glosser, Latex Patching Plaster, Latex Base Filler, Linseed Oil, Shellac, Thinners, Solvents, and Other Materials Not Specifically Indicated But Required To Achieve Finishes Specified: Pure, of highest commercial quality, compatible with coatings and acceptable to coating manufacturer.

2.04 MIXING

- A. Unless otherwise specified herein or pre-approved, use ready-mixed, pre-tinted colors matching approved samples. Site tinting will not be permitted.
- B. Thoroughly mix and stir coatings before use to ensure homogeneous dispersion of ingredients. Prior to application, box (blend) multiple containers of same material and color by pouring from one container to another several times to ensure uniform consistency, color, and smoothness.
- C. Mix only in clean mixing pails of material recommended by manufacturer to avoid contamination.
- D. Remove film which may form on surface of material in containers and strain material before using. Stir frequently during use to maintain pigments in suspension. Do not stir film into material.
- E. Where thinner is required, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.
- F. If required, thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Architect.
- G. Apply coatings of consistency recommended by manufacturer. Thin only within recommended limits using thinners approved by coating manufacturer

PART 3 EXECUTION

3.01 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. For examining substrates of existing construction see Division 09 Section "Maintenance Repainting."
- C. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Masonry (Clay and CMU): 12 percent.
 3. Wood: 15 percent.
 4. Gypsum Board: 12 percent.
 5. Plaster and Gypsum Plaster: 12 percent.

- D. Gypsum Board Substrates: Verify that finishing compound is dry or cured and sanded smooth. Verify that finish level is appropriate to paint sheen to be applied. Pay particular attention to areas subject to critical (severe) lighting as defined in GA-214.
- E. Plaster Substrates: Verify that plaster is fully cured.
- F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" and "MPI Maintenance Repainting Manual" applicable to substrates indicated.
- B. For preparing substrates of existing construction see Division 09 Section "Maintenance Repainting."
- C. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- D. Protect adjacent interior surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, etc., from painting operations and damage using drop cloths, shields, masking, templates, or other suitable protective means. Repair damage caused by failure to provide such protection.
- E. Do not paint the following surfaces:
 - 1. Clay and glass unit masonry.
 - 2. Stone.
 - 3. Aluminum and aluminum based alloys, copper and copper based alloys, lead and lead based alloys, nickel and nickel based alloys, stainless steel, plated architectural metals, and "weathering" metals.
 - 4. Decorative plastic and metal laminates.
 - 5. Synthetic countertops.
 - 6. Elastomeric membranes and flashings, and roofing materials.
 - 7. Sealants and caulking unless otherwise indicated.
 - 8. Acoustic materials.
 - 9. Rubber, vinyl, plastic, and other resilient seals and bumpers.
 - 10. Surfaces concealed or inaccessible in finished construction unless specifically required.
 - 11. Other surfaces specifically scheduled or indicated to remain unfinished or unpainted.
- F. Do not paint the following materials and products:
 - 1. Items with integral finish or factory-applied final finish, unless otherwise indicated.
 - 2. Airway grating.
 - 3. Wire mesh partitions and gates, metal and wire storage shelving.
 - 4. Moving parts of operating equipment such as valve and damper operators, linkages, sensing devices, motor and fan shafts.
 - 5. UL, FM or other code-required labels, name plates, identification or performance rating labels.
 - 6. Mechanical and electrical items concealed or inaccessible in finished construction unless specifically indicated to be painted.
 - 7. Wire and decorative fencing.
 - 8. Cast metal stair nosings, tree grates, trench drain grates, manhole covers, and curb inlets.

3.03 SURFACE PREPARATION

- A. 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.
- B. Concrete Vertical Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
 - 1. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
- C. Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi at 6 to 12 inches.
- D. Concrete Masonry (CMU) Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Bare (Unprimed) Steel Substrates: Remove rust and loose mill scale.
 - 1. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - a. Interior steel members located in high moisture environments, and equipment rooms,: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Other Interior Locations: SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and touch up exposed areas with the same primer as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
 - 1. Verify shop primers have not exceeded manufacturer's exposure time prior to topcoating. If exceeded, follow prime coat manufacturer's recommendations for rework required prior to topcoating.
- G. Interior Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- I. Plastic Substrates (PVA / PVC materials, etc.): Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.04 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Coat all surfaces specified, scheduled, illustrated, and otherwise exposed unless specifically noted otherwise.
 - 2. Use applicators and techniques suited for paint and substrate indicated.
 - 3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

4. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Apply paint and coatings within an appropriate time frame after cleaning when environmental conditions encourage flash-rusting, rusting, contamination or the manufacturer's paint specifications require earlier applications.
- C. Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
 1. Unless otherwise directed, apply a minimum of four coats of paint where deep or bright colors are used to achieve satisfactory results
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brushmarks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.
 1. Number of coats specified are minimum number acceptable.
 2. Apply coating systems to total dry film thickness scheduled. Apply material at not less than manufacturer's recommended spreading rate. Do not exceed maximum single coat thickness recommended by coating manufacturer. Do not double back with spray equipment building up film thickness of two coats in one pass.
 3. Allow previously applied coat to dry before next coat is applied.
 4. Sand and dust lightly between coats as recommended by paint manufacturer.
 5. Ensure that edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent of flat surfaces.
 6. Finish edges of coatings adjoining other materials or colors sharp and clean, without overlapping.
- E. Interior Sheen Requirements: Except as noted herein or indicated on the Room Finish Schedule interior surfaces shall be painted in accordance with the following criteria over appropriate prime / sealer coat:
 1. Walls (except as noted): G3 (eggshell).
 2. Ceilings (except as noted): G1 (flat).
 3. Public washrooms / toilets:
 - a. Wet and Splash-Zone Surfaces: G5 (semi-gloss).
 4. Kitchens: G5 (semi-gloss).
 5. Metal surfaces (doors, frames, railings, structure, etc.): G5 (semi-gloss).
 6. Wood surfaces (transparent): G4 (satin).
 7. Wood surfaces (opaque): G5 (semi-gloss).
 8. Inside of Light Valances: G6 (gloss) white.
- F. Finish Matching:
 1. Finish closets, niches, alcoves, and similar spaces the same as adjoining rooms, unless otherwise indicated.
 2. Finish tops, bottoms, and edges of doors the same as door faces. When faces are different colors, finish edges of doors to match space from which they are visible when door is in partly open position.
 3. Finish other surfaces not specifically scheduled to match color of adjoining surfaces.
- G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work: Paint surfaces visible in the finished construction as follows:
 1. Paint items exposed in occupied spaces including, but not limited to, the following:
 - a. Fire Suppression, Plumbing, HVAC Work:
 - 1) Uninsulated metal and plastic piping.

- 2) Piping with insulation covering or jacket material.
 - 3) Pipe hangers and supports.
 - 4) Ducts without external insulation covering.
 - 5) Ducts and equipment with insulation covering or other jacket material.
 - 6) Internal surfaces of unlined ducts visible through air inlets and outlets visible from occupied spaces. Paint flat black.
 - 7) Equipment and tanks with factory-primed finish.
 - 8) Equipment and tanks with factory-applied final finishes, unless otherwise indicated.
 - 9) Fin tube radiation covers, unless otherwise indicated.
 - b. Electrical, Communication, and Electronic Safety and Security Work:
 - 1) Conduits, raceways, and wiring device boxes. Do not paint wiring devices or covers unless specifically indicated to be field painted.
 - 2) Switchgear.
 - 3) Panelboards.
 - 4) Equipment with factory-primed finish.
 - 5) Equipment, excluding lighting fixtures, with factory-applied final finishes, unless otherwise indicated.
2. Paint items exposed in equipment rooms and non-public spaces including, but not limited to, the following:
 - a. Backprime and paint face and edges of plywood service panels for telephone and electrical equipment before installation in color to match adjacent wall surface.
 - b. Fire Suppression, Plumbing, HVAC Work:
 - 1) Uninsulated metal piping.
 - 2) Pipe hangers and supports.
 - 3) Equipment and tanks with factory-primed finish.
 - c. Electrical, Communication, and Electronic Safety and Security Work:
 - 1) Equipment with factory-primed finish
3. Color Coding Mechanical and Electrical Work:
 - a. Refer to Mechanical Sections for identification banding of equipment, ductwork, piping, and conduit. Where indicated to be painted, color code equipment, piping, and conduit in accordance with the following.
 - 1) Colors: Comply with ANSI/ASME A131.1 Scheme for the Identification of Piping Systems.
 - (a) Materials Inherently Hazardous: Yellow.
 - (b) Liquid or Liquid Admixtures Materials of Inherently Low Hazard: Green.
 - (c) Gas or Gaseous Admixtures Materials of Inherently Low Hazard: Blue.
 - (d) Fire Quenching Materials: Red.
 - b. Coordinate with Mechanical Sections for determination of piping contents and color required.
4. Prior to finishing mechanical and electrical items, remove louvers, grilles, covers, and access panels and finish separately. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.05 FIELD QUALITY CONTROL / STANDARD OF ACCEPTANCE

- A. Field Tests: Perform the following tests:
 1. Periodically test film thickness of each coat with wet film gage to ensure coatings are being applied to proper thickness.
- B. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.
- C. Field Observations: Architect and Owner's Representative will perform the following:
1. Review surfaces, preparation and paint applications.
 2. Request review of each applied coat by Architect before application of successive coats. Only reviewed coats will be considered in determining number of coats applied.
 3. Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the inspector:
 - a. Brush marks, roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
 - b. Evidence of poor coverage at fastener heads (bolts, rivets, screws, etc.), plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
 - c. Damage due to touching before paint is sufficiently dry or any other contributory cause.
 - d. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
 - e. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
 4. Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
 - a. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 - b. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 - c. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
 - d. When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- D. Painted surfaces rejected by the inspector shall be repaired at the expense of the Contractor.
1. Small affected areas may be touched up.
 2. Large affected areas and areas without sufficient dry film thickness of paint shall be repainted.
 3. Runs, sags, and damaged paint shall be removed by scraper or by sanding prior to re-application of paint.

3.06 CLEANING AND PROTECTION

- A. At end of each workday, remove combustible rubbish materials, empty cans, rags, and other discarded materials from Project site and safely dispose of in accordance with requirements of authorities having jurisdiction.
- B. Promptly remove spilled, splashed, or spattered coatings. After completing paint application, clean remaining spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Clean paint from finished surfaces using cleaning agents and methods which will not damage materials. Do not scratch or damage adjacent finished surfaces.
1. If completed construction is damaged beyond normal cleaning or repair by painting operations, replace damaged items at no additional cost to Owner.
- C. Provide "Wet Paint" signs and other methods to protect newly coated surfaces. Remove when directed or when no longer needed.

- D. Clean equipment and dispose of wash water, cleaning solvents, and other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paint removers / strippers, paints, and thinners in accordance with safety requirements of authorities having jurisdiction.
- E. 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.
- F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.07 INTERIOR PAINTING SCHEDULE

- A. Refer to separate Paint Systems Schedule for areas of application and color selection.

END OF SECTION 09 91 23

SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Markerboards.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For visual display units.
 - 1. Include plans, elevations, sections, details, and attachment to other work.
 - 2. Show locations of panel joints.
- C. Samples: For each type of visual display unit indicated.
- D. Product Schedule: For visual display units.

1.04 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranties.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.06 WARRANTY

- A. Warranty Period: Life of the building.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.

2.02 MARKERBOARD PANELS (GL-10)

- 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. Claurus
- B. Writable and Magnetic Glass
 - 1. Basis of Design: Clarus Wall2Wall
 - a. Non-staining writing surface
 - b. Magnetic Finish
 - c. Thickness: 1/4" tempered safety glass
 - d. Eased Corners
 - e. Claurus Opti-Clear Polish
 - f. Color: as indicated on material index
 - g. installation Hardware: Float Hardware by Clarus

2.03 MATERIALS

- A. Glass: 1/4" Clarus tempered safety writing glass
- B. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

- C. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

2.04 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.
 - 1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

END OF SECTION 10 11 00

SECTION 10 14 23 - SIGNAGE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Panel signs.
 - 2. Exit and Room Identification Signs

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For all signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.04 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance data: For signs to include in maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain each sign type through one source from a single manufacturer.
- B. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of signage and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with A/E or Designer's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.07 FIELD CONDITIONS

- A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.08 COORDINATION

- A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.
 - 1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

1.09 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation of delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.02 PANEL SIGNS

- 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. ASI Sign Systems, Inc.
 - 2. System 2/90
 - 3. Allen Industries, Inc.
 - 4. APCO Graphics, Inc.
 - 5. Best Sign Systems Inc.
 - 6. InPro Corporation.
 - 7. Nelson-Harkins Industries.
 - 8. Poblocki Sign Company, LLC.
 - 9. Seton Identification Products.
 - 10. Supersine Company (The); Division of Stamp-Rite, Inc.
- B. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Solid-Sheet Sign, Returns, and Back: Acrylic sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph below and as follows:
 - a. Thickness: 0.125
 - b. Surface-Applied Graphics: Applied vinyl film or photo image.
 - 2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to acrylic backing sheet to produce composite sheet
 - a. Composite-Sheet Thickness: 0.25 inch
 - b. Surface-Applied Graphics: Applied vinyl film or hpoto image
 - c. Subsurface Graphics: Reverse halftone or dot-screen image with slide-in changeable insert.
 - 3. Sign-Panel Perimeter: Finish edges smooth
 - a. Edge Condition: Square cut.
 - b. Corner Condition in Elevation: Square
 - 4. Mounting: As Follows (unless noted otherwise)
 - a. On Doors: Countersunk tamper-resistant screws
 - b. On Gypsum Board: Surface mounted to wall with manufacturer's standard method
 - c. On Masonry: Surface mounted to shim plate fastened to masonry with countersunk fasteners
 - d. On Glass: Two-faced tape with opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.
 - 5. Surface Finish and Applied Graphics:

- a. Painted Finish and Graphics: Manufacturer's standard, factory-applied acrylic polyurethane, in color as selected by Architect from manufacturer's full range.
 - b. Photo-Image Graphics: Manufacturer's standard multicolor, 600-dpi halftone or dot-screen image.
 - c. Building Floor Plans: Provided by Architect to sign manufacturer. The signage company will be responsible for determining appropriate exit routes.
 - d. Overcoat: Manufacturer's standard baked-on clear coating.
6. Text and Typeface: Accessible raised characters and Braille; typeface as selected by Architect from manufacturer's full range and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.
 7. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

2.03 EXIT AND ROOM-IDENTIFICATION SIGNAGE

- A. Manufacturer: Subject to compliance with requirements, products which may be incorporated into the work include but are not limited to the following:
 1. ASI Sign Systems, Inc.
 2. System 2/90
 3. Allen Industries, Inc.
 4. APCO Graphics, Inc.
 5. Best Sign Systems Inc.
 6. InPro Corporation.
 7. Nelson-Harkins Industries.
 8. Poblocki Sign Company, LLC.
 9. Seton Identification Products.
 10. Supersine Company (The); Division of Stamp-Rite, Inc.
- B. Sign Construction:
 1. Plate material shall be 0.102 inch 3003 alloy H-14 aluminum sheet. The plate shall have smooth, even, level surfaces, constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.
 2. Signs shall be mechanically fabricated with smoothly finished square cut edges.
 3. Corners shall be (rounded to radius or square) as indicated on Sign Type Drawings.
 4. All characters, Braille, and graphics are to be raised 1/32 inch (0.032 inch) by a die-raised process. The character shoulder of the style indicated on the Sign Type Drawings shall be precisely formed, with sharp, well-defined edges, not rolled or embossed.
 5. The raised characters and graphics shall be masked to allow the background and Braille to be painted with smooth, acrylic enamel finish. The character and graphic portions of the signs shall be anodized, with a satin finish.
 6. Back-shields (if required) at all wall mounted locations shall be cut from 0.102 inch H-14 Aluminum, and painted.
 7. Back-shields at signs mounted on glass shall be cut from 1/32 inch thick acrylic sheet, with a reverse screen printed colored background.
- C. Supplementary Construction for Inserts;
 1. Radiused window opening in face plate shall be mechanically cut, as indicated on the Sign Type Drawings. Face plate window shall allow for complete view of name on insert, and shall completely overlay insert edges.
 2. Back- plate material shall be 0.031 inch thick H-14 3003 alloy aluminum sheet.
 3. Back-plate shall be mechanically fabricated with square cut edges and radius corners as indicated on Sign Type Drawings.
 4. Spacers shall be fabricated on 0.063 inch thick H-14 3003 alloy aluminum sheet.
 5. Spacers are to be placed between the face and back-plate to allow name insert to be accessible from the right hand side of sign. Spacers shall allow insert to drop down into

- position at window opening. Manufacturer shall provide a vandal resistant screw to secure name insert. Gravity-lock position shall prevent insert from being removed from the side unless raised to previous insert position.
6. Name insert shall be fabricated of 0.30 inch thick clear acrylic. Reverse painted to match sign color.
 7. Names shall be reverse die cut 3 mm Gerber vinyl. Characters shall be precisely formed with sharp, well defined edges.
 8. Colors:
 - a. Plate background and Braille: Standard color as selected by Architect.
 - b. Raised characters and graphics: Standard color as selected by Architect.
 - c. Aluminum and acrylic back-shields: Color to match sign background.
 - d. Field color for name insert: Custom color to match Architect's sample. Standard color as selected by Architect.
 - e. Name insert characters: Custom color to match Architect's sample. Standard color as selected by Architect.

2.04 SIGN MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper as indicated or as recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Acrylic Sheet: ASTM D 4802, Type UVF (UV filtering).
- D. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.
- E. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.05 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 1. Use concealed fasteners and anchors unless indicated to be exposed.
 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use flathead countersunk screws and bolts with tamper-resistant slots unless otherwise indicated.
 4. Sign Mounting Fasteners:
 - a. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
- B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.06 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 4. Internally brace signs for stability and for securing fasteners.
 5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.
- D. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:
1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by Owner.

2.07 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.08 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class II, 0.010 mm or thicker.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected

3.02 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to accessibility standard.
- C. Mounting Methods:
1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
 3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
 4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
 5. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
- D. Signs Mounted on Glass:
1. Mount signs directly on glass with two-face tape, supplemented with clear silicone adhesive.
 2. Provide opaque sheet matching sign material and finish installed by similar method on opposite side of glass to conceal back of sign.

3.03 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.

- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 23

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 10 22 39.01 - MANUAL FOLDING PANEL PARTITION - BASE BID TO ALTERNATE NO. 4

PART 1 - GENERAL

1.01 1.01 DESCRIPTION

- A. General
 - 1. Furnish and install operable partitions and suspension system. Provide all labor, materials, tools, equipment, and services for operable walls in accordance with provisions of contract documents.

1.02 1.02 RELATED WORK BY OTHERS

- A. Preparation of opening will be by General Contractor. Any deviation of site conditions contrary to approved shop drawings must be called to the attention of the architect.
- B. All header, blocking, support structures, jambs, track enclosures, surrounding insulation, and sound baffles as required in 1.04 Quality Assurance.
- C. Prepunching of support structure in accordance with approved shop drawings.
- D. Paint or otherwise finishing all trim and other materials adjoining head and jamb of operable partitions.

1.03 1.03 SUBMITTALS

- A. Complete shop drawings are to be provided prior to fabrication indicating construction and installation details. Shop drawings must be submitted within 60 days after receipt of signed contract.

1.04 1.04 QUALITY ASSURANCE

- A. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions
- B. The partition STC (Sound Transmission Classification) shall be achieved per the standard test methods ASTM E90.
- C. Noise isolation classifications shall be achieved per the standard test methods ASTM E336 and ASTM E413.
- D. Noise Reduction Coefficient (NRC) ratings shall be per ASTM C423.
- E. Rack testing for 10 years. (tensional strength stress test)
- F. The manufacturer shall have a quality system that is registered to the ISO 9001 standards.

1.05 1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Proper storage of partitions before installation and continued protection during and after installation will be the responsibility of the General Contractor.

1.06 1.06 WARRANTY

- A. Partition system shall be guaranteed for a period of two years against defects in material and workmanship, excluding abuse.

PART 2 - PRODUCTS

2.01 2.01 ACCEPTABLE MANUFACTURERS

- A. Upon compliance with all of the criteria specified in this section, Manufacturers wishing to bid products equal to the product specified must submit to the architect 10 days prior to bidding complete data in support of compliance and a list of three past installations of products similar to those listed. The submitting manufacturer guarantees the proposed substituted product complies with the performance items specified and as detailed on the drawings.
 - 1. Moderfold
 - 2. Hufcor
 - 3. Skyfold

4. Advanced Equipment Corp

2.02 2.02 MATERIALS

- A. Product to be Hufcor top supported Series 632 paired panels as manufactured by Hufcor Inc.
 - 1. Panels shall be nominally 3" [76] thick, to 48" [1219] in width, and hinged in pairs.
 - 2. Panel faces shall be laminated to appropriate substrate to meet the STC requirement in 2.04 Acoustical Performance.
 - a. Horizontal Splice: Heights over 16'3" [4953] with non-steel faces require a structural splice placed at approximately 12'3" [3734] from the floor.
 - 3. Frames shall be of 16 gauge [1.42mm] painted steel with integral factory applied aluminum vertical edge and face protection.
 - 4. Vertical sound seals shall be of tongue and groove configuration, ensure panel-to-panel alignment and prevent sound leaks between panels.
 - 5. Horizontal top seals shall be fixed continuous contact dual 4-finger vinyl.
 - 6. Horizontal bottom seals shall be retractable, provide up to 2" [50] nominal operating clearance, and exert downward force when extended. Optional Seals:
 - a. Horizontal bottom seals shall be automatic and provide up to 2" [50] nominal operating clearance. (Consult your Hufcor Distributor for more information.)
 - 7. Horizontal trim shall be of aluminum.
 - 8. Low profile hinges on basic panels shall be of steel and project no more than 1/4" [6] beyond panel faces. Each pair of panels to have a minimum of three hinges.
- B. Weight of the panels shall be 5.7-10.2 lbs. per sq. ft. [27.8-49.8kg/sq.m] based on options selected.
- C. Suspension system:
 - 1. Track shall be of clear anodized architectural grade extruded aluminum alloy 6063-T6. Track design shall provide precise alignment at the trolley running surfaces and provide integral support for adjoining ceiling, soffit, or plenum sound barrier. Track shall be connected to the structural support by pairs of minimum 3/8" [10] dia. threaded steel hanger rods. Guide rails and/or track sweep seals shall not be required.
 - a. Each panel shall be supported by one 4-wheeled carrier. Wheels to be of hardened steel ball bearings encased with molded polymer tires.
 - 2. Plenum closure (by others): Design of plenum closure must permit lifting out of header panels to adjust track height. Plenum closure required for optimum sound control of partition.
- D. Finishes
 - 1. Face finish shall be: (select as required):
 - a. (1) Customer selected: Wilsonart / New Age Oak / #7938-38 & Pewter Mesh / #4878-38
 - 2. Exposed metal trim and seal color shall be (select from Hufcor's Standard Trim selector):
 - a. Gray (standard)
 - 3. Aluminum track shall be clear anodized

2.03 2.03 OPERATION

- A. Panels shall be manually moved from the storage area, positioned in the opening, and seals set.
- B. Retractable Horizontal Seals
 - 1. Retractable horizontal seals shall be activated by a removable quick-set operating handle located approximately 42" [1067] from the floor in the panel edge.
 - 2. All retractable seals in each hinged pair shall be operated simultaneously.
 - 3. Seal activation requires approximately 15 lbs. [6.8 kg] of force per panel and approximately a 190 degree turn of the removable handle.
- C. Final partition closure to be by (select one):

1. Lever closure panel with expanding jamb which compensates for minor wall irregularities and provides a minimum of 250 lbs. [113.4kg] seal force against the adjacent wall for optimum sound control. The jamb activator shall be located approximately 45" [1143] from the floor in the panel face and be accessed from either side of the panel. The jamb is equipped with a mechanical rack and pinion gear drive mechanism and shall extend 4"-6" [100-152] by turning the removable operating handle.
- D. Stack/Store Panels
 1. Retract seals and move to storage area. Panels may be stored at either or both ends of the track or in a pocket.

2.04 2.04 ACOUSTICAL PERFORMANCE

- A. Acoustical performance shall be tested at a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) and in accordance with ASTM E90 Test Standards. Standard panel construction shall have obtained an STC rating of 49
 1. Complete, unaltered written test report is to be made available upon request.

PART 3 - EXECUTION

3.01 INSTALLATION. THE COMPLETE INSTALLATION OF THE OPERABLE WALL SYSTEM SHALL BE BY AN AUTHORIZED FACTORY-TRAINED INSTALLER AND BE IN STRICT ACCORDANCE WITH THE APPROVED SHOP DRAWINGS AND MANUFACTURER'S STANDARD PRINTED SPECIFICATIONS, INSTRUCTIONS, AND RECOMMENDATIONS.

3.02 CLEANING

- A. All track and panel surfaces shall be wiped clean and free of handprints, grease, and soil.
- B. Cartoning and other installation debris shall be removed to onsite waste collection area, provided by others.
- C. Training
 1. Installer shall demonstrate proper operation and maintenance procedures to owner's representative.
 2. Operating handle and owners manuals shall be provided to owner's representative.

END OF SECTION 10 22 39.01

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

SECTION 10 22 39.02 - ELECTRIC FOLDING PANEL PARTITION - ALTERNATE NO. 4

PART 1 - GENERAL

1.01 1.01 DESCRIPTION

- A. General
 - 1. Furnish and install operable partitions and suspension system. Provide all labor, materials, tools, equipment, and services for operable walls in accordance with provisions of contract documents.

1.02 1.02 RELATED WORK BY OTHERS

- A. Preparation of opening will be by General Contractor. Any deviation of site conditions contrary to approved shop drawings must be called to the attention of the architect.
- B. All header, blocking, support structures, jambs, track enclosures, surrounding insulation, and sound baffles as required in 1.04 Quality Assurance.
- C. Prepunching of support structure in accordance with approved shop drawings.
- D. Paint or otherwise finishing all trim and other materials adjoining head and jamb of operable partitions.

1.03 1.03 SUBMITTALS

- A. Complete shop drawings are to be provided prior to fabrication indicating construction and installation details. Shop drawings must be submitted within 60 days after receipt of signed contract.

1.04 1.04 QUALITY ASSURANCE

- A. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions
- B. The partition STC (Sound Transmission Classification) shall be achieved per the standard test methods ASTM E90.
- C. Noise isolation classifications shall be achieved per the standard test methods ASTM E336 and ASTM E413.
- D. Noise Reduction Coefficient (NRC) ratings shall be per ASTM C423.
- E. Rack testing for 10 years. (tensional strength stress test)
- F. The manufacturer shall have a quality system that is registered to the ISO 9001 standards.

1.05 1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Proper storage of partitions before installation and continued protection during and after installation will be the responsibility of the General Contractor.

1.06 1.06 WARRANTY

- A. Partition system shall be guaranteed for a period of two years against defects in material and workmanship, excluding abuse.

PART 2 - PRODUCTS

2.01 2.01 ACCEPTABLE MANUFACTURERS

- A. Upon compliance with all of the criteria specified in this section, Manufacturers wishing to bid products equal to the product specified must submit to the architect 10 days prior to bidding complete data in support of compliance and a list of three past installations of products similar to those listed. The submitting manufacturer guarantees the proposed substituted product complies with the performance items specified and as detailed on the drawings.

2.02 2.02 MATERIALS

- A. Product to be top supported Series 643E electrically operated, continuously hinged panels as manufactured by Hufcor Inc.

1. Panels shall be nominally 4" [101] thick, to 48-1/2" [1232] in width, and continuously hinged.
 2. Panel faces shall be laminated to appropriate substrate to meet the STC requirement in 2.04 Acoustical Performance.
 - a. Horizontal Splice: Heights over 16'3" [4953] with non-steel faces require a structural splice placed at approximately 12'3" [3734] from the floor.
 3. Frames shall be of 16 gauge [1.42mm] painted steel with integral factory applied aluminum vertical edge and face protection.
 4. Vertical sound seals shall be of tongue and groove configuration, ensure panel-to-panel alignment and prevent sound leaks between panels.
 5. Horizontal top seals shall be fixed continuous contact dual 4-finger vinyl.
 6. All standard panels shall have bottom retractable seals which provide a minimum of 2" [51] floor clearance during movement of the partition, including all panels adjacent to pass door(s). Retractable bottom floor seal to exert downward seal force when activated. Floating or rigid seals that maintain contact with the floor during partition movement will not be acceptable.
 7. Motor shall automatically extend/retract the bottom seals.
 8. No floor mounted seal activators are allowed.
 9. Panels must provide wall-to-wall contact for tight acoustical seal. Operable wall systems that do not extend to the back of storage pocket are not acceptable.
- B. Weight of the panels shall be 7.8-10.9 lbs. per sq. ft. [37.8-53.2 kg/sq m] based on options selected.
- C. Suspension system
1. For panels to 900 lbs. [409 kg]: Track shall be of clear anodized architectural grade extruded aluminum alloy 6063-T6. Track design shall provide precise alignment at the trolley running surfaces and provide integral support for adjoining ceiling, soffit, or plenum sound barrier. Guide rails and/or track sweep seals shall not be required. Track shall be connected to the structural support by pairs of minimum 3/8" [10] dia. threaded steel hanger rods.
 - a. Each panel shall be supported by one 4-wheeled carrier in the track and one internal 4-wheeled carrier. Wheels to be of hardened steel ball bearings encased with molded polymer tires.
 2. For panels over 900 lbs. [409 kg]: Track shall be of 1/4" formed steel. Track shall be connected to the structural support by pairs of min. 1/2" [13] dia. threaded steel hanger rods.
 - a. Each panel shall be supported by one 4-wheeled carrier in the track and one internal 4-wheeled carrier. Wheels on track carrier to be of hardened steel ball bearings. Wheels on internal carrier shall be of hardened steel ball bearings encased with molded polymer tires.
 3. Factory assembled power unit shall be UL listed and include motor, electronic torque limiter, two key control stations wired in series, emergency release, and all necessary equipment for electric operation. Roller chain drive shall attach to carrier of lead panel. Limit switches shall be provided to prevent over-travel. Motor shall be able to operate 50-60 hz., and 200-240 volts, single phase with adequate horsepower to operate partition effectively.
- D. Safety Requirements:
1. Low profile hinges shall be of steel and project no more than 1/4" [6] beyond panel faces. Panels to have a minimum of three hinges.
 2. Each panel must be supported by a single carrier allowing the panels to stack freely without the use of rub rails near the pocket, thus decreasing the risk of injury while stacking into a pocket.

3. Partition shall be operated by two (2) control stations wired in series and located on opposite sides and ends of the partition. The key stations require human contact to be activated ensuring supervised operation of the partition system.
- E. Finishes
 1. Face finish shall be: (select as required):
 - a. Customer selected: Wilsonart / New Age Oak / #7938-38 & Pewter Mesh / #4878-38
 2. Exposed metal trim and seal color shall be (select from Hufcor's Standard Trim selector):
 - a. Gray (standard)
 3. Aluminum track shall be clear anodized

2.03 2.03 OPERATION

- A. Partitions shall be key switch controlled, requiring constant contact to activate the motor. As a safety precaution, two key switches are required to activate the partition. Switches to be mounted on both sides of partition to provide operators a clear view of the partition path to prevent injury.
- B. Motor drive shall automatically seal the partition in the opening. For models with retractable bottom seals, the motor automatically sets the bottom seals.
- C. Stack/Store Panels
 1. Panels are retracted and stored by activating the two key-switch controls.

2.04 2.04 ACOUSTICAL PERFORMANCE

- A. Acoustical performance shall be tested at a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) and in accordance with ASTM E90 Test Standards. Standard panel construction shall have obtained an STC rating of 54
 1. Complete, unaltered written test report is to be made available upon request.

PART 3 - EXECUTION

3.01 INSTALLATION. THE COMPLETE INSTALLATION OF THE OPERABLE WALL SYSTEM SHALL BE BY AN AUTHORIZED FACTORY-TRAINED INSTALLER AND BE IN STRICT ACCORDANCE WITH THE APPROVED SHOP DRAWINGS AND MANUFACTURER'S STANDARD PRINTED SPECIFICATIONS, INSTRUCTIONS, AND RECOMMENDATIONS.

3.02 CLEANING

- A. All track and panel surfaces shall be wiped clean and free of handprints, grease, and soil.
- B. Cartoning and other installation debris shall be removed to onsite waste collection area, provided by others.
- C. Training
 1. Installer shall demonstrate proper operation and maintenance procedures to owner's representative.
 2. Operating keys and owners manuals shall be provided to owner's representative.

END OF SECTION 10 22 39.02

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

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HAA Project Number: 2013088.22
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SECTION 10 28 00 - TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Private-use bathroom accessories.
 - 2. Underlavatory guards.
 - 3. Custodial accessories.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.04 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.06 MAINTENANCE MATERIALS

- A. Provide special tools and wrenches supplied by product manufacturer applicable to each component furnished by this Section.

1.07 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.
- B. 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.

1.08 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.09 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: Comply with Section 308 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.
- B. Operational Requirements:
 - 1. Provide units with operational controls which are operable with one hand and which do not require tight grasping, pinching, or twisting of the wrist.
 - 2. Force required to operate push buttons, knobs, pistons, hinged panels, and other operable elements shall be no greater than 5 lb.
 - 3. Locate controls, dispensing outlets, and other features requiring access at the following heights:
 - a. For Unobstructed Front and Side Access Approach: Not more than 48 inches and not less than 15 inches above floor level.
 - b. For Obstructed Front Access Approach: Not more than 48 inches above floor level for countertops up to 20 inch projection; not more than 44 inches above floor level for countertops from 20 to 25 inch projection.
 - c. For Obstructed Side Access Approach: Not more than 48 inches above floor level for obstructions projecting up to 10 inches; not more than 46 inches above floor level for obstructions projecting from 10 to 24 inches.
- C. Structural Requirements: Allowable stresses in bending, shear, and tension shall not be exceeded for materials used when a vertical or horizontal force of 250 lb is applied at any point on grab bars, seats, fastener mounting devices, or supporting structure.

2.02 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
 - 1. Toilet and Bath Accessories:
 - a. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
 - d. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
 - e. Truebro Co.
 - f. Brocar Products
 - 2. Underlavatory Guards:
 - a. Plumberex Specialty Products, Inc.
 - b. Truebro by IPS Corporation.

2.03 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.04 WASHROOM & BATHROOM ACCESSORIES

- A. WSU supplier for Toilet Accessories has been Allied Eagle, 1801 Howard St. Detroit MI 48216, 313.230.0770
- B. Toilet Tissue (Roll) Dispenser (TP1):
 - 1. Manufacturer: San Jamar
 - 2. Model: 9" Twin 9" Jumbo Bath Tissue Dispenser Oceans SANR4009TBK
 - 3. Finish: Black
 - 4. Mounting: Surface/Dual Roll
- C. Xlerator Hand Dryer (TP2):
 - 1. Manufacturer: Excel Dryers
 - 2. Model: XL-SB
 - 3. Finish: Brushed Stainless Steel
 - 4. Mounting: ADA compliant recess kit / #40502
 - 5. Mounting: Surface
- D. Liquid-Soap Dispenser (TP3):
 - 1. Manufacturer: Dial
 - 2. Model: 1 Liter, CM-K-00396
 - 3. Finish: Smoke
 - 4. Mounting: Surface
- E. Sanitary Napkin Receptacle (TP5):
 - 1. Manufacturer: Impact Products, LLC
 - 2. Model: 1102
 - 3. Finish: Black
 - 4. Mounting: wall mount
- F. Paper Towel (Folded) Dispenser (TP6):
 - 1. Manufacturer: San Jamar
 - 2. Model: Integra, SANT850TBK
 - 3. Finish: Black
 - 4. Mounting: Surface
- G. Grab Bars (G1, G2):
 - 1. Manufacturer: Bobrick
 - 2. Model: B-6806.99
 - 3. Finish: Satin Stainless Steel
 - 4. Mounting: Surface (configuration as indicated in drawings).
- H. Robe Hook (T1 and T2):
 - 1. Manufacturer: Bobrick
 - 2. Model: B-6717
 - 3. Finish: Stainless Steel
 - 4. Mounting: Surface
- I. Mirror Unit (T4):
 - 1. Manufacturer: Bobrick
 - 2. Model: B-290 2436

- 3. Finish: Satin Stainless Steel
- 4. Mounting: Surface
- J. Baby Changing Station (T7):
 - 1. Manufacturer: Koala Kare
 - 2. Model: KB112-01CT
 - 3. Finish: Thermoformed high-density polyethylene
 - 4. Mounting: Surface

2.05 CUSTODIAL ACCESSORIES

- A. Mop and Broom Holder (T3):
 - 1. Manufacturer: Bobrick
 - 2. Model: B-239
 - 3. Finish: Satin Stainless Steel
 - 4. Mounting: Surface

2.06 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.
- C. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

3.02 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes fire-protection cabinets for portable fire extinguishers.
- B. Related Requirements Section 104416 "Fire Extinguishers."

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fire-protection cabinets.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.05 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.06 SEQUENCING

- A. Apply decals on field-painted fire-protection cabinets after painting is complete.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.02 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Larsen's Manufacturing.
 - c. Potter Roemer LLC.
 - d. Amerex.
- B. Cabinet Construction: Non rated and rated for fire-resistance rating of walls where they are installed.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - 1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
- E. Semi-recessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation.

1. 1. Rolled-Edge Trim: 4-inch maximum backbend depth.
- F. Cabinet Trim Material: Same material and finish as door.
- G. Door Material: Steel sheet
- H. Door Style: Fully glazed panel with frame.
- I. Door Glazing: Clear Float Glass.
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 1. Provide projecting door pull and friction latch
 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- K. Accessories:
 1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
- L. Materials:
 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: Manufacturer's standard white.
 2. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, [3] [6] mm thick.

2.03 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Prepare recesses for recessed and semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.
- B. Install fire-protection cabinets in locations and at mounting heights indicated
- C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
- D. Identification: Apply decals at required locations.
- E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- F. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- G. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- H. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Manually operated roller shades with single rollers.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- C. Samples: For each exposed product and for each color and texture specified, 10 inches (250 mm) long.
- D. Samples for Verification: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 inches (250 mm) square. Mark inside face of material if applicable.
 - 2. Roller Shade: Full-size operating unit, not less than 16 inches (400 mm) wide by 36 inches (900 mm) long for each type of roller shade indicated.
 - 3. Installation Accessories: Full-size unit, not less than 10 inches (250 mm) long.
- E. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material, signed by product manufacturer.
- C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals.

1.06 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. Roller Shades: Full-size units equal to 10 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to 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 Architect specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.09 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. MechoShade Systems, Inc.
 2. Or Architect approved equal.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.
- C. Utilize salvaged shades and return to original location as numbered for reinstallation. Replace shades as required due to damage or reconfiguration of spaces.

2.02 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS (WT-1)

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 1. Bead Chains: Stainless steel.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Chain tensioner, sill mounted.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 1. Roller Drive-End Location: Left side of inside face of shade.
 2. Direction of Shadeband Roll: Regular, from back of roller.
 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- E. Shadebands:
 1. Shadeband Material: Light-filtering fabric.

2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- F. Installation Accessories:
 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than height indicated on Drawings.
 2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than height indicated on Drawings.
 3. Endcap Covers: To cover exposed endcaps.
 4. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
 5. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
 6. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.03 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant. Provide mockups for WT-1 and WT-2 material as identified in the Material Index for verification of openness factors and color selection.
 1. Source: Roller-shade manufacturer, Mechoshade, Product: EcoVeil
 2. Type: 100% thermoplastic olefin (TPO).
 3. Weave: Basketweave.
 4. Thickness: Manufacturer's Standard.
 5. Weight: Manufacturer's Standard.
 6. Roll Width: 100 inches (254 cm).
 7. Orientation on Shadeband: As indicated on Drawings - A.2 Series.
 8. Openness Factor: As indicated on Material Index and as determined through mockup.
 9. GreenGuard Certification; Cradle to Cradle design.
 10. Color: As noted on the Material Index on drawings.

2.04 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
 2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

3.03 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 12 32 00 - MANUFACTURED WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured standard casework, with cabinet hardware.
- B. Countertops.

1.02 RELATED REQUIREMENTS

- A. Section 12 36 00 - Countertops: Additional requirements for countertops.
- B. Section 22 40 00 - Plumbing Fixtures: Sinks and fittings installed in casework.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- B. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Component dimensions, configurations, construction details, joint details, attachments.
- C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements, placement dimensions and tolerances, clearances required, and keying information.
- D. Samples for Finish Selection: Fully finished, for color selection. Minimum sample size: 2 inches by 3 inches.
 - 1. Thermally fused laminate samples, for color, texture, and finish selection.
- E. Manufacturer's Installation Instructions.
- F. Maintenance Data: Manufacturer's recommendations for care and cleaning.
- G. Finish touch-up kit for each type and color of materials provided.

1.05 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Thermally Fused Laminate Casework:
- B. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.02 CASEWORK, GENERAL

- A. Quality Standard: AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Thermally Fused Laminate Cabinets: Economy Grade.

2.03 FABRICATION

- A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.
- B. Construction: As required for selected grade.

- C. Fittings and Fixture Locations: Cut and drill components for fittings and fixtures.
- D. Edging: Fit shelves, doors, and exposed edges with specified and detailed edging. Do not use more than one piece for any single length.
- E. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.
- F. Matching Wood Grain: Comply with requirements of quality standard for specified grade and as follows:

2.04 THERMALLY FUSED LAMINATE CASEWORK

- A. Thermally Fused Laminate Casework: Thermally fused laminate panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base cabinets.
 - 1. Style: Flush overlay. Ease doors and drawer fronts slightly at all edges.
 - 2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions:
 - a. Base Cabinets: 24 inches.
 - b. Tall Cabinets: 22 inches.
 - c. Wall Cabinets: 16 inches.
 - 3. Panels: Grade M-S particleboard or Grade 155 MDF core, with melamine-impregnated decorative surface papers and transparent protective topcoat; NEMA LD 3 Type VGL.
 - a. Finish: Matte or suede, gloss rating of 5 to 20.
 - b. Surface Color and Pattern: As indicated on drawings.
 - c. Special Texture: Simulated wood.

2.05 COUNTERTOPS

- A. Types: More than one type is required. See drawings for location of each type of countertop.
- B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.

2.06 CABINET HARDWARE

- A. Manufacturer's standard types, styles and finishes, and as indicated below.
- B. Locks: Provide locks on casework drawers and doors where indicated. Lock with 5 pin cylinder and 2 keys per lock.
- C. Shelves in Cabinets:
 - 1. Shelf Standards and Rests: Vertical standards with rubber button fitted rests, satin chromium plated over nickel on base material.
- D. Swinging Doors: Hinges, pulls, and catches.
 - 1. Hinges: Concealed, number as required by referenced standards for width, height, and weight of door.
 - a. Concealed Hinges: Installed in cabinet edge, and on door back, bright chromium plated over nickel on base material.
 - 2. Pulls: as indicated on drawings _____, 6 inches wide.
 - a. Pull design to conform to project's referenced accessibility requirements.
 - 3. Catches: Magnetic.
- E. Drawers: Pulls and slides.
 - 1. Pulls: as indicated on drawings wire pulls, 6 inches wide.

2. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width.

2.07 MATERIALS

- A. Wood-Based Materials:
 1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
- B. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.
- C. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.

PART 3 EXECUTION

3.01 PREPARATION

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

3.02 EXAMINATION

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

3.03 INSTALLATION

- A. Perform installation in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.
- E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:
 1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
 2. Variation of Bottoms of Wall Cabinets from Level: 1/8 inch in 10 feet.
 3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
 4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
 5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.
- F. Secure wall and floor cabinets to concealed reinforcement at gypsum board assemblies.

- G. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
- H. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches on center.
- I. Install hardware uniformly and precisely.
- J. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.
- K. Replace units that are damaged, including those that have damaged finishes.

3.04 ADJUSTING

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

3.05 CLEANING

- A. Clean casework and other installed surfaces thoroughly.

3.06 PROTECTION

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

END OF SECTION 12 32 00

SECTION 20 05 00 MECHANICAL GENERAL REQUIREMENTS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 INDUSTRY STANDARDS	1
1.04 PERFORMANCE REQUIREMENTS	2
1.05 QUALITY ASSURANCE	2
1.06 CODES, PERMITS AND FEES	3
1.07 DRAWINGS	3
1.08 MATERIAL AND EQUIPMENT MANUFACTURERS	3
1.09 INSPECTION OF SITE	4
1.10 ITEMS REQUIRING PRIOR APPROVAL	4
1.11 SUBMITTALS	4
1.12 COORDINATION DRAWINGS	5
1.13 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS	5
1.14 RECORD DRAWINGS	5
1.15 INSTRUCTION OF OWNER PERSONNEL	6
1.16 WARRANTY	6
PART 2 PRODUCTS	6
PART 3 EXECUTION	6
3.01 MECHANICAL DEMOLITION WORK	6
3.02 REFRIGERANT HANDLING	7
3.03 WORK IN EXISTING BUILDINGS	7
3.04 TEMPORARY SERVICES	7
3.05 WORK INVOLVING OTHER TRADES	7
3.06 ACCEPTANCE PROCEDURE	7
3.07 PROJECT COMMISSIONING	8

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes mechanical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 01 Specification Sections.

1.03 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
 1. AABC – Associated Air Balance Council.
 2. ABMA - American Bearing Manufacturers Association.
 3. ABMA – American Boiler Manufacturers Association.
 4. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The).
 5. AMCA - Air Movement and Control Association International, Inc.
 6. ANSI – American National Standards Institute.
 7. ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers.
 8. ASTM – American Society for Testing Materials.
 9. CDA – Copper Development Association.

10. CGA – Compressed Gas Association.
 11. CSA – CSA International.
 12. HI – Hydraulic Institute.
 13. Intertek – Intertek Group.
 14. NAIMA – North American Insulation Manufacturers Association.
 15. NEBB – National Environmental Balancing Bureau.
 16. NEC – National Electrical Code.
 17. NECA - National Electrical Contractors Association.
 18. NEMA – National Electrical Manufacturer's Association.
 19. NFPA – National Fire Protection Association.
 20. SMACNA – Sheet Metal and Air Conditioning Contractors National Association.
 21. UL – Underwriter's Laboratories, Inc.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.04 PERFORMANCE REQUIREMENTS

- A. Systems Components Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

1.05 QUALITY ASSURANCE

- A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the mechanical systems as specified and as indicated on Drawings.
1. Contract Documents are complimentary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bids shall be based on the most expensive combination of quality and quantity of the work indicated.
- B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of ASHRAE, NFPA, SMACNA and UL, unless otherwise indicated.
1. Notify the Architect/Engineer in writing before submitting a proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations.
 2. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without notice to A/E, the Contractor shall bear all costs arising from corrective measures.
- C. Source Limitations: Obtain equipment and other components of the same or similar systems through one source from a single manufacturer.
- D. Tests and Inspections: Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.
- E. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the trades involved.
- F. Sequence and Schedule: Perform work to avoid interference with the work of other trades. Remove and relocate work which in the opinion of the Owner's Representatives causes interference.
- G. Labeling Requirement for Packaged Equipment: Electrical panels on packaged mechanical equipment shall bear UL label or label of other Nationally Recognized Testing Laboratory (NRTL) (Intertek, CSA, etc.).

1.06 CODES, PERMITS AND FEES

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for Mechanical Work shall be secured and paid for by the Contractor. All Work shall conform to all applicable codes, rules and regulations.
- B. Rules of local utility companies shall be complied with. Check with each utility company supplying service to the installation and determine all devices including, but not limited to, all valves, meter boxes, and meters which will be required and include the cost of all such items in proposal.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.07 DRAWINGS

- A. The drawings show the location and general arrangement of equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly. Provide fittings, valves, and accessories as required to meet actual conditions.
- C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The Architectural and Structural Drawings take precedence in all matters pertaining to the building structure, Mechanical Drawings in all matters pertaining to Mechanical Trades and Electrical Drawings in all matters pertaining to Electrical Trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.
- E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

1.08 MATERIAL AND EQUIPMENT MANUFACTURERS

- A. Equipment: All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment and shall be the manufacturer's latest design.
- B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, piping, sheet metal, electrical work, and building alterations shall be included in the original Bid.
- C. All package unit equipment and skid mounted mechanical components that are factory assembled shall meet, in detail, the products named and specified within each section of the Mechanical and Electrical Specifications.
- D. Changes Involving Electrical Work: The design of the mechanical systems is based on the equipment scheduled on the Drawings. Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified with no additional cost to

project. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1. Where equipment changes are made that involve additional Electrical Work (larger size motor, additional wiring of equipment, etc.) the Mechanical Trades involved shall compensate the Electrical Trades for the cost of the additional Work required.

1.09 INSPECTION OF SITE

- A. Visit the site, examine and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.
- B. No contract sum adjustments or contract time extensions will be made for Contractor claims arising from conditions which were or could have been observable, ascertainable or reasonably foreseeable from a site visit or inquiry into local conditions affecting the execution of the work.

1.10 ITEMS REQUIRING PRIOR APPROVAL

- A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 01 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.
 1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.
 2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, piping, sheet metal, electrical, replacement of other components, and building alterations shall be included in the original bid.
- B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid, but will not affect the awarding of the contract.

1.11 SUBMITTALS

- A. Submit project specific submittals for review in compliance with Division 01.
- B. Prepare shop drawings to scale for the Architect/Engineer for review. Equipment and material submittals required are indicated in the Mechanical; Fire Suppression; Plumbing; and Heating, Ventilating and Air Conditioning Sections. Refer to Division 01 for submittal quantities.
- C. All submittals shall be submitted in groupings of similar and/or related items. Plumbing fixture submittals shall be submitted as one package including all fixtures intended to be used for this project. Incomplete submittal groupings will be returned "Rejected". Submit shop drawing with identification mark number or symbol numbers as specified or scheduled on the Mechanical Drawings.
- D. All submittals shall be project specific. Standard detail drawings and schedule not clearly indicating which data is associated with this Project will be returned "Rejected".
- E. Shop drawings shall be reviewed by the Mechanical Contractor for completeness and accuracy prior to submitting to the Architect/Engineer for review. The shop drawings shall be dated and signed by the Mechanical Contractor prior to submission.
- F. No equipment shall be shipped from stock or fabricated until shop drawings for them have been reviewed by the Architect/Engineer. Review is only for general conformance with the design

concept of the project and general compliance with the information given in the Contract Documents. Any action indicated is subject to the requirement of the plans and specifications.

1. By the review of shop drawings, the Architect/Engineer does not assume responsibility for actual dimensions or for the fit of completed work in position, nor does such review relieve Mechanical Trades of full responsibility for the proper and correct execution of the work required.
 2. Contractor is responsible for:
 - a. Dimensions, which shall be confirmed and correlated at the job site.
 - b. Fabrication processes and techniques of construction.
 - c. Quantities.
 - d. Coordination of Contractor's work with all other trades.
 - e. Satisfactory performance of Contractor's work.
 - f. Temporary aspects of the construction process.
- G. Submit detailed shop drawings of piping systems showing pipe routing and types and locations of all pipe hangers.
- H. If deviations (not substitutions) from Contract Documents are deemed necessary by the Contractor, details of such deviations, including changes in related portions of the project and the reasons therefore, shall be submitted with the submittal for approval.

1.12 COORDINATION DRAWINGS

- A. Submit project specified coordination drawings for review in compliance with Division 01 Specification Sections.

1.13 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS

- A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 01 Specification Sections.
- B. Provide complete operation and maintenance instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. One copy of all manuals shall be furnished for Owner. Maintenance and operating instructional manuals shall be provided when construction is approximately 75 percent complete.
- C. Format: Submit operations and maintenance manuals in the following format:
1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
- D. Operation and maintenance instructional manuals shall be submitted a minimum of four (4) weeks prior to functional testing.
- E. The operating and maintenance instructions shall include a brief, general description for all mechanical systems including, but not limited to:
1. Routine maintenance procedures.
 2. Lubrication chart listing all types of lubricants to be used for each piece of equipment and the recommended frequency of lubrication.
 3. Trouble-shooting procedures.
 4. Contractor's telephone numbers for warranty repair service.
 5. Submittals.
 6. Recommended spare parts lists.
 7. Names and telephone numbers of major material suppliers and subcontractors.
 8. System schematic drawings.

1.14 RECORD DRAWINGS

- A. Submit record drawings in compliance with Division 01.

- B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media or vellum which have been neatly marked to represent as-built conditions for all new mechanical work.
- C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request.

1.15 INSTRUCTION OF OWNER PERSONNEL

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of mechanical equipment and systems at agreed upon times. A minimum of 24 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.
- B. For equipment requiring seasonal operation, perform instructions for other seasons within six months.
- C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- D. In addition to individual equipment training provide overview of each mechanical system. Utilize the as-built documents for this overview.
- E. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction.

1.16 WARRANTY

- A. Warranty: Comply with the requirements in Division 01 Specification Sections. Contractor shall warranty that the mechanical installation is free from defects and agrees to replace or repair, to the Owner's satisfaction, any part of this mechanical installation which becomes defective within a period of one year (unless specified otherwise in other Mechanical; Fire Suppression; Plumbing; or Heating, Ventilating and Air Conditioning Sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.
- B. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 MECHANICAL DEMOLITION WORK

- A. All demolition of existing mechanical equipment and materials shall be done by the Contractor unless otherwise indicated. Include all items such as, but not limited to, existing piping, draining of piping, pumps, ductwork, supports and equipment where such items are not required for the proper operation of the modified system.
- B. In general, demolition work is indicated on the Drawings. However, the Contractor shall visit the job site to determine the full extent and character of this Work.
- C. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Remove items from the systems and turn over to the Owner in their condition prior to removal. The Owner shall move and store these materials. Items on which the Owner waives ownership shall become the property of the Contractor, who shall remove and legally dispose of same, away from the premises.
- D. Work that has been cut or partially removed shall be protected against damage until covered by permanent construction.

- E. Clean and flush the interior and exterior of all existing relocated equipment and its related piping, valves, and accessories that are to be reused of all mud, debris, pipe dope, oils, welding slag, loose mill scale, rust and other extraneous material so that the existing equipment and all accessories can be repainted and repaired as required to place in first-class working condition.
- F. Where existing equipment is to be removed, cap piping under floor, behind face of wall, above ceiling or at mains. Cap or plug piping with same or compatible piping material.
- G. Cap ductwork and cap piping immediately adjacent to demolition as soon as demolition commences in order to allow existing systems to remain in operation.
 - 1. Cap or plug piping with same or compatible piping material.
 - 2. Cap or plug ducts with same or compatible ductwork material.

3.02 REFRIGERANT HANDLING

- A. Refrigerant Installation and Disposal: Perform all work related to refrigerant contained in chillers, cooling coils, air conditioners, and similar equipment, including related piping, in strict accordance with the following requirements:
 - 1. ASHRAE Standard 15 and Related Revisions: Safety Code for Mechanical Refrigeration.
 - 2. ASHRAE Standard 34 and Related Revisions: Number Designation and Safety Classification of Refrigerants.
 - 3. United States Environmental Protection Agency (US EPA) requirements of Section 8 08 (Prohibition of Venting and Regulation of CFC) and applicable State and Local regulations of authorities having jurisdiction.
- B. Recovered refrigerant is the property of the Contractor. Dispose of refrigerant legally, in accordance with applicable rules and regulations.

3.03 WORK IN EXISTING BUILDINGS

- A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once Work is started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.
- B. Adequately protect and preserve all existing and newly installed Work. Promptly repair any damage to same at Contractor's expense.
- C. Consult with the Owner's Representative as to the methods of carrying on the Work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's Representative.
- D. Prior to starting work in any area, obtain approval for doing so from a qualified representative of the Owner who is designated and authorized by the Owner to perform testing and abatement, if necessary, of all hazardous materials including but not limited to, asbestos. The Contractor shall not perform any inspection, testing, containment, removal or other work that is related in any way whatsoever to hazardous materials under the Contract.

3.04 TEMPORARY SERVICES

- A. Provide temporary service as described in Division 01.

3.05 WORK INVOLVING OTHER TRADES

- A. Certain items of equipment or materials specified in the Mechanical Division may have to be installed by other trades due to code requirements or union jurisdictional requirements. In such instances, the Contractor shall complete the work through an approved, qualified subcontractor and shall include the full cost for same in proposal.

3.06 ACCEPTANCE PROCEDURE

- A. Upon successful completion of start-up and recalibration, but prior to building acceptance, substantial completion and commencement of warranties, the Architect/Engineer shall be requested in writing to observe the satisfactory operation of all mechanical control systems.

- B. The Contractor shall demonstrate operation of equipment and control systems, including each individual component, to the Owner and Architect/Engineer.
- C. After correcting all items appearing on the punch list, make a second written request to the Owner and Architect/Engineer for observation and approval.
- D. After all items on the punch list are corrected and formal approval of the mechanical systems is provided by the Architect/Engineer, the Contractor shall indicate to the Owner in writing the commencement of the warranty period.
- E. Operation of the following systems shall be demonstrated:
 - 1. Air Handling Systems.
 - 2. Temperature Controls.
 - 3. Exhaust Systems.
- F. For systems requiring seasonal operation, demonstrate system performance within six months when weather conditions are suitable.

3.07 PROJECT COMMISSIONING

- A. Refer to Division 01 "Project Commissioning" and the Commissioning Manual.
- B. Purpose: Training, documentation and verification of the operation and functional performance of mechanical systems for compliance with the "design intent."

END OF SECTION 20 05 00

SECTION 20 05 10
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	2
1.03 DEFINITIONS	2
1.04 SUBMITTALS	2
1.05 QUALITY ASSURANCE	2
1.06 DELIVERY, STORAGE, AND HANDLING	3
1.07 COORDINATION	3
PART 2 PRODUCTS	3
2.01 MANUFACTURERS	3
2.02 PIPE, TUBE, AND FITTINGS	4
2.03 JOINING MATERIALS	4
2.04 PIPE THREAD COMPOUNDS	4
2.05 TRANSITION FITTINGS	5
2.06 DIELECTRIC FITTINGS	5
2.07 MODULAR MECHANICAL SEALS	5
2.08 SLEEVES	6
2.09 ESCUTCHEONS	6
2.10 GROUT	6
2.11 EPOXY BONDING COMPOUND	6
2.12 LEAK DETECTOR SOLUTION	6
2.13 PIPE ROOF PENETRATION ENCLOSURES	7
PART 3 EXECUTION	7
3.01 PIPING SYSTEMS - COMMON REQUIREMENTS	7
3.02 PIPING JOINT CONSTRUCTION	10
3.03 ACCESS DOORS	11
3.04 EQUIPMENT CONNECTIONS	11
3.05 PIPING CONNECTIONS	11
3.06 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS	12
3.07 PAINTING	12
3.08 ERECTION OF METAL SUPPORTS AND ANCHORAGES	12
3.09 EPOXY BONDING TO EXISTING MATERIALS	12
3.10 JACKING OF PIPE	12
3.11 ERECTION OF WOOD SUPPORTS AND ANCHORAGES	12
3.12 GROUTING	13
3.13 CUTTING, CORING AND PATCHING	13
3.14 EXCAVATION AND BACKFILLING	13
3.15 FLASHING	13
3.16 LUBRICATION	13
3.17 FILTERS	13
3.18 CLEANING	14

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 20 Section "Mechanical General Requirements."
 2. Division 22 Section "Domestic Water Piping" for flushing and cleaning of potable water piping.

3. Division 23 Section "Piping Systems Flushing and Chemical Cleaning" for flushing and cleaning of HVAC piping.

1.02 SUMMARY

- A. This section includes mechanical materials and installation methods common to mechanical piping systems, sheet metal systems and equipment. This section supplements all other Division 20, 21, 22, and 23 Mechanical Sections, and Division 01 Specification Sections.

1.03 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 2. CPVC: Chlorinated polyvinyl chloride plastic.
 3. PE: Polyethylene plastic.
 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 2. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

- A. Product Data: For the following:
 1. Transition fittings.
 2. Dielectric fittings.
 3. Mechanical sleeve seals.
 4. Escutcheons.
- B. Welding certificates.
- C. Brazing Certificates: As required by ASME Boiler and Pressure Vessel Code, Section IX, or AWS B2.2.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.
- C. Comply with NSF 372, "Drinking Water System Components – Lead Content" for potable domestic water piping and components.
- D. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- E. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- F. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
- G. Soldering: Qualify processes and operators according to AWS B2.3/2.3M, "Specification for Soldering Procedure and Performance Qualification."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection: Provide adequate weather protected storage space for all mechanical equipment and materials deliveries to the job site. Storage locations will be designated by the Owner's Representative. Equipment stored in unprotected areas must be provided with temporary protection.
1. Protect equipment and materials from theft, injury or damage.
 2. Protect equipment outlets, pipe and duct openings with temporary plugs or caps.
 3. Materials with enamel or glaze surface shall be protected from damage by covering and/or coating as recommended in bulletin "Handling and Care of Enameled Cast Iron Plumbing Fixtures", issued by the Plumbing Fixtures Manufacturer Association, and as approved.
 4. Electrical equipment furnished by Mechanical Trades and installed by the Electrical Trades: Turn over to Electrical Trades in good condition, receive written confirmation of same.
 5. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
 6. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations. Coordinate with other trades to ensure accurate locations and sizes of mechanical spaces, chases, slots, shafts, recesses and openings.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Install Work to avoid interference with work of other trades including, but not limited to, Architectural and Electrical Trades. Remove and relocate any work that causes an interference at Contractor's expense.
- D. Coordinate requirements for and provide access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
- E. The mechanical trades shall be responsible for all damage to other work caused by their work or through the neglect of their workers.
1. All patching and repair of any such damaged work shall be performed by the trades which installed the work. The cost shall be paid by the Mechanical Trades.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21, 22, and 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

- A. Refer to individual Division 21, 22, and 23 piping Sections for special joining materials not listed below.
- B. Unions: Pipe Size 2 Inches and Smaller:
 - 1. Ferrous pipe: Malleable iron ground joint type unions.
 - 2. Unions in galvanized piping system shall be galvanized.
 - 3. Copper tube and pipe: Bronze unions with soldered joints.
- C. Flanges: Pipe Sizes 2-1/2 Inch and Larger:
 - 1. Ferrous pipe: Standard weight, forged steel weld neck flanges.
 - 2. Copper tube and pipe: Slip-on bronze flanges.
- D. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- E. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated. Square head bolts and nuts are not acceptable.
- F. Solder Filler Metals: ASTM B 32, lead-free, antimony-free, silver-bearing alloys. Include water-flushable flux according to ASTM B 813.
- G. Brazing Filler Metals: Alloys meeting AWS A5.8.
 - 1. Use Type BcuP Series, silver-bearing, copper-phosphorus alloys for joining copper or bronze socket fittings with copper pipe. Flux is prohibited unless used with bronze fittings.
 - 2. Use Type Bag Series, cadmium-free silver alloys for joining copper with steel, stainless steel, or other ferrous alloys.
- H. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- I. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

2.04 PIPE THREAD COMPOUNDS

- A. Pipe thread compounds for the fluid service compatible with piping materials provided.
- B. Compounds for potable water service and similar applications acceptable to U.S. Department of Agriculture (USDA) or Food and Drug Administration (FDA). Compounds containing lead are prohibited.
- C. Inorganic zinc-rich coatings or corrosion inhibited proprietary compounds for galvanized carbon steel systems to coat raw carbon steel surfaces, in lieu of subsequent painting.
 - 1. Manufacturers:
 - a. Carboline "Carbo-Zinc 12."
 - b. Tnemec.
 - c. Koppers.
- D. Use tetrafluoroethylene (Teflon) tape 2 to 3 mils thick for natural gas system threaded joints.

1. Manufacturers:
 - a. Cadillac Plastic.
 - b. Permacel.
 - c. Other approved.

2.05 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 4. Aboveground Pressure Piping: Pipe fitting.

2.06 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Brass Unions, Brass Nipples, Brass Couplings: For systems up to 286 deg F.
- D. Dielectric-Flange Kits: Include full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; female NPT threaded ends; and 300-psig minimum working pressure at 225 deg F.
 1. Manufacturers:
 - a. Lochinvar Corp.; V-Line Insulating Couplings.
- F. Dielectric Nipple/Waterway Fittings: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, male NPT threaded, or grooved ends; and 300-psig minimum working pressure at 230 deg F.
 1. Manufacturers:
 - a. Anvil International, Inc.; Gruvlok Manufacturing; DI-LOK Nipples.
 - b. Elster Group; Perfection Corp.; ClearFlow.
 - c. Precision Plumbing Products, Inc.; ClearFlow.
 - d. Sioux Chief Manufacturing Co., Inc.
 - e. Tyco Fire & Building Products; Grinnell Mechanical Products; Figure 407 ClearFlow.
 - f. Victaulic Co. of America; Style 47 ClearFlow.

2.07 MODULAR MECHANICAL SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve or pipe and core drilled hole.
 1. Manufacturers:
 - a. Advance Products & Systems, Inc.; Innerlynx.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.; Thunderline Link Seal.
 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Carbon steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.08 SLEEVES

- A. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, and 0.375 inch wall black.
- B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, and 0.375 inch wall galvanized, plain ends.
- C. Water Stop: Cast or ductile-iron; fabricated steel; PVC; or rotationally molded HDPE pipe; with plain ends and integral water stop, unless otherwise indicated.
 1. Manufacturers:
 - a. Advance Products & Systems, Inc.; Infinity and Gal-Vo-Plast Sleeves.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with set screws.

2.09 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping or Piping in High Humidity Areas: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping in Finished Spaces: One-piece, stamped-steel type.
 - e. Bare Piping in Unfinished Service Spaces or Equipment Rooms: Split-plate, stamped-steel type with concealed hinge and set screw.
 2. Existing Piping: Use the following:
 - a. Chrome-Plated Piping or Piping in High Humidity Areas: Split-casting, cast-brass type with chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - c. Bare Piping: Split-plate, stamped-steel type with set screw or spring clips.

2.10 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

2.11 EPOXY BONDING COMPOUND

- A. Two-component system suitable for bonding wet or dry concrete to each other and to other materials.
- B. Manufacturers:
 1. Euco 452 #450; Euclid Chemical Co.
 2. Epobond; L & M Construction Chemicals.
 3. Sikadur 87; Sika Corp.

2.12 LEAK DETECTOR SOLUTION

- A. Commercial leak detector solution for pipe system testing.
- B. Manufacturers:

1. American Gas and Chemicals Inc.; Leak Tec.
2. Cole-Parmer Inst. Co.; Leak Detector.
3. Guy Speaker Co. Inc.; Squirt 'n Bubbles.

2.13 PIPE ROOF PENETRATION ENCLOSURES

- A. Manufacturers:
 1. Pate Company (The).
 2. Portals Plus, Inc.
 3. Thybar Corporation; Thycurb.
- B. Minimum 18 gage welded galvanized steel construction.
- C. Integral base plate.
- D. Built-in fully mitered cant.
- E. Factory installed insect and decay resistant wood nailer.
- F. Factory installed 1-1/2 inch thick, 3 pounds per cubic foot density rigid insulation.
- G. EPDM compression molded rubber cap for single or multiple pipes as required.
- H. Stainless steel draw-band clamps.

PART 3 EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Refer to piping application schedules on the Drawings.
- B. Install piping according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems, and in accordance with manufacturer's instructions.
- C. 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. The Drawings shall be followed as closely as elements of construction will permit.
- D. During the progress of construction, protect open ends of pipe, fittings, and valves to prevent the admission of foreign matter. Place plugs or flanges in the ends of all installed work whenever work stops. Plugs shall be commercially manufactured products.
- E. Prior to and during laying of pipe, maintain excavations dry and clear of water and extraneous materials. Provide minimum 4 inches of clearance in all directions for pipe passing under or through building grade beams.
- F. Weld-o-lets and thread-o-lets can be used for annular flow measuring devices, temperature control components, and thermal wells in steel pipe. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
- G. Brazolets can be used for annular flow measuring devices, temperature control components, and thermal wells in copper tube. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
- H. Clean and lubricate elastomer joints prior to assembly.
- I. Clean damaged galvanized surfaces and touch-up with a zinc rich coating.
- J. Install piping to conserve building space and not interfere with use of space.
- K. Group piping whenever practical at common elevations.
- L. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- M. Slope piping and arrange systems to drain at low points.
- N. Slope horizontal piping containing noncondensable gases 1 inch per 100 feet, upward in the direction of the flow.

- O. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- P. 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.
- Q. In concealed locations where piping, other than black steel, cast-iron, or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1-1/2 inches from the nearest edge of the member, the pipe shall be protected by shield plates. Protective shield plates shall be a minimum of 1/16 inch thick steel, shall cover the area of the pipe where the member is notched or bored, and shall extend a minimum of 2 inches above sole plates and below top plates.
- R. Do not penetrate building structural members unless specifically indicated on drawings.
- S. Install piping above accessible ceilings to allow sufficient space for ceiling panel and light fixture removal.
- T. Install valves with stems upright or horizontal, not inverted.
- U. Provide clearance for installation of insulation and access to valves and fittings.
- V. Install piping to permit valve and equipment servicing. Do not install piping below valves and/or terminal equipment. Do not install piping above electrical equipment.
- W. Install piping at indicated slopes. Provide drain valves with hose end connections and caps at all piping low points, where piping is trapped and at all equipment.
- X. Install piping free of sags and bends.
- Y. Install fittings for changes in direction and branch connections.
- Z. Unless otherwise indicated or specified, install branch connections to mains using tee fittings in main pipe:
 - 1. Branch connected to bottom of main pipe for HVAC systems. Side connection is acceptable. Connection above centerline of main is unacceptable. For up-feed risers, connect branch to top of main pipe.
 - 2. Branch connected to top of main for steam and condensate, plumbing systems, compressible gasses, and vacuum.
- AA. Install piping to allow application of insulation.
- BB. Select system components with pressure rating equal to or greater than system operating pressure.
- CC. After completion, fill, clean, and treat systems. Refer to Division 23 Sections "Hydronic Piping," "Piping Systems Flushing and Chemical Cleaning," and "HVAC Water Treatment."
- DD. Install escutcheons for penetrations of walls below ceiling, and ceilings.
- EE. Sleeves are not required for core-drilled holes in poured concrete walls.
- FF. Permanent sleeves are not required for holes formed by removable PE sleeves in poured concrete walls.
- GG. Install sleeves for pipes passing through footings and foundation walls, masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces of walls.
 - a. Exception: Extend sleeves installed in floors 2 inches above finished floor level.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Schedule 40 Black Steel Sleeves: For pipes smaller than NPS 12 penetrating interior walls.
 - b. 0.375 Inch Wall Black Steel Sleeves: For pipes NPS 12 and larger penetrating interior walls.

- c. Schedule 40 Galvanized Steel Sleeves: For pipes smaller than NPS 12 penetrating floors, and roof slabs.
 - d. 0.375 Inch Wall Galvanized Steel Sleeves: For pipes NPS 12 and larger penetrating floors and roof slabs.
 - e. For pipes penetrating floors with membrane water proofing provide cast iron sleeve with clamping flanges. Secure/seal membrane to sleeves with clamping flanges.
 - 4. Seal sleeves in concrete floors roof slabs and masonry walls with grout.
 - 5. Seal sleeves in plaster/gypsumboard partitions with plaster or dry wall compound and caulk with non-hardening silicone sealant to provide airtight installation.
 - 6. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- HH. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and modular mechanical seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing modular mechanical seals.
- 1. Install Schedule 40 galvanized steel pipe for sleeves smaller than 12 inches in diameter.
 - 2. Install 0.375 galvanized steel pipe for sleeves 12 inches and larger in diameter.
 - 3. Modular Mechanical Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble modular mechanical seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- II. New, Poured Concrete, Underground, Exterior-Wall and Slab on Grade Pipe Penetrations: Install water stop sleeves prior to pour. Seal pipe penetrations using modular mechanical seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing modular mechanical seals.
- 1. Modular Mechanical Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble modular mechanical seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- JJ. Existing Underground, Exterior-Wall and Slab on Grade Pipe Penetrations: Seal core drilled pipe penetrations using modular mechanical seals. Allow for 1-inch annular clear space between pipe and cored opening for installing modular mechanical seals.
- 1. Modular Mechanical Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of cored hole. Assemble modular mechanical seals and install in annular space between pipe and cored opening. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- KK. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Specification Sections for materials.
- LL. Seal openings around pipes in sleeves and around duct openings through walls, floors and ceilings, and where floors, fire rated walls and smoke barriers are penetrated. Fire and/or smoke barriers shall be UL listed firestopping and shall have a fire rating equal to or greater than the penetrated barrier. Refer to Division 07 Specification Sections for materials.
- MM. Pipe Roof Penetration Enclosures:
- 1. Coordinate delivery of roof penetration enclosures to jobsite.
 - 2. Locate and set curbs on roof.
 - 3. Framing, flashing, and attachment to roof structure are specified under Division 07.
 - 4. Attach cap to curbs, cut pipe boots to fit pipe, and clamp boots to pipe or conduit.
- NN. Verify final equipment locations for roughing-in.
- OO. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems.
- B. Cut piping square.
- C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- D. Remove scale, slag, dirt, oil, and debris from inside and outside of pipe and fittings before assembly.
- E. Clean damaged galvanized surfaces and touch-up with a zinc rich coating.
- F. Use standard long sweep pipe fittings for changes in direction. No mitered joints or field fabricated pipe bends will be permitted. Short radius elbows may be used where specified or specifically authorized by the Architect.
- G. Make tee connections with screwed tee fittings, soldered fittings or specified welded connections. Make welded branch connections with either welding tees or forged branch outlet fittings in accordance with ASTM A234, ANSI B16.9 and ANSI B16.11. For forged branch outlets, furnish forged fittings flared for improved flow where attached to the run, reinforced against external strains and to full pipe-bursting strength requirements. "Fishmouth" connections are not acceptable.
- H. Use eccentric reducers for drainage and venting of pipe lines; bushings are not permitted.
- I. Provide pipe openings using fittings for all systems control devices, thermometers, gauges, etc. Drilling and tapping of pipe wall for connections is prohibited.
- J. Provide temperature sensing device thermal wells and similar piping specialty connections.
- K. Provide instrument connections except thermal wells with specified isolating valves at point of connection to system.
- L. Locate instrument connections in accordance with manufacturer's instructions for accurate read-out of function sensed. Locate instrument connections for easy reading and service of devices.
- M. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- N. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- O. 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.
- P. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
 - 1. Weld-o-lets and thread-o-lets can be used for annular flow measuring devices, temperature control components, and thermal wells. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
- Q. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on gaskets and bolt threads.
 - 1. Assemble flanged joints with fresh-stock gasket and hex head nuts, bolts or studs. Make clearance between flange faces such that the connections can be gasketed and bolted tight without strain on the piping system. Align flange faces parallel and bores concentric; center gaskets on the flange faces without projection into the bore.

2. Lubricate bolts before assembly to insure uniform bolt stressing. Draw up and tighten bolts in staggered sequence to prevent unequal gasket compression and deformation of the flanges. Do not mate a flange with a raised face to a companion flange with a flat face; machine the raised face down to a smooth matching surface and use a full face gasket. After the piping system has been tested and is in service at its maximum temperature, check bolting torque to provide required gasket stress.
- R. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Galvanized piping shall be cut grooved to prevent damage to galvanizing on internal pipe surfaces. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.
- S. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials. Refer to Application Schedules on the Drawings.
- T. Remake joints which fail pressure tests with new materials including pipe, fittings, gaskets and/or a filler.

3.03 ACCESS DOORS

- A. Provide access doors for installation by architectural trades **unless noted otherwise**. Provide access doors in the walls, as required to make all valves, controls, coils, motors, air vents, filters, electrical boxes and other equipment installed by the Contractor accessible. Minimum size 12 inches x 12 inches. Provide access doors in the ceiling, for accessibility as mentioned above, 24 inches x 24 inches minimum size. Areas with accessible ceilings (ceilings where lay-in panels are not fastened in place and can be individually removed without removal of adjacent tiles) will not require access doors. Refer to Division 08 Section "Access Doors and Frames" for manufacturers and model numbers and additional information.
- B. When access doors are in fire resistant walls or ceilings, they shall bear the Underwriters' Laboratories, Inc., Label, with time design rating equal to or greater than the wall or ceiling unless they were a part of the tested assembly.

3.04 EQUIPMENT CONNECTIONS

- A. Make connections to equipment, fixtures, and other items included in the work in accordance with the submittals and rough-in measurements furnished by the manufacturers of the particular equipment furnished.
 1. Any and all additional connections not shown on the drawings but shown on the equipment manufacturer's submittal or required for the successful operation of the equipment shall be installed as part of this Contract at no additional charge to the Owner.
- B. All piping connections to pumps, coils, and other equipment shall be installed without strain at the pipe connection of this equipment. When directed, remove the bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected.

3.05 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 1. Install unions, in piping NPS 2 and smaller, where indicated on Drawings, at final connection to each piece of equipment and at all control valves.
 2. Install flanges, in piping NPS 2-1/2 and larger, where indicated on Drawings, at final connection to each piece of equipment and at all control valves.

3.06 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated. Housekeeping pad locations and sizes shall be coordinated by mechanical contractor prior to the placement of concrete slabs.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.
- E. For suspended equipment, furnish and install all inserts, rods, structural steel frames, brackets and platforms required. Obtain approval of Architect for same including loads, locations and methods of attachment.
- F. Equipment Rigging Over Roof Areas: Protect building structure against damage during equipment rigging. Make provisions to distribute load of equipment to main roof structure, and to prevent damage to roof decking, roofing, or purlins.
- G. The Contract Documents indicate items to be purchased and installed. The items are noted by a manufacturer's name, catalog number and/or brief description. The catalog number may not designate all the accessory parts for a particular application. Arrange with the manufacturer for the purchase of all items required for a complete installation.

3.07 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 09.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.08 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Where pipe and/or equipment support members must be welded to structural building framing, Contractor shall seek prior approval from Architect and structural engineer. Scrape, brush clean, and apply one coat of zinc rich primer after welding.
- D. Field Welding: Comply with AWS D1.1.

3.09 EPOXY BONDING TO EXISTING MATERIALS

- A. Use epoxy bonding compound to set sleeves or pipes in existing concrete to bond new concrete and/or grout to existing materials or to bond dissimilar materials.
- B. The compound, when applied in accordance with the manufacturer's instructions, shall be capable of initial curing within 48 hours at temperatures as low as 40 deg F and shall be capable of bonding any combination of the following properly prepared materials: Wet or dry, cured or uncured concrete or mortar; vitrified clay; cast iron and carbon steel.

3.10 JACKING OF PIPE

- A. Do not jack pipe in place except upon prior approval of proposed materials and complete details of methods.

3.11 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.12 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.13 CUTTING, CORING AND PATCHING

- A. Refer to Division 01 Specification Sections for requirements for cutting, coring, patching and refinishing work necessary for the installation of mechanical work.
- B. All cutting, coring, patching and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

3.14 EXCAVATION AND BACKFILLING

- A. Refer to Division 31 Specification Sections.
- B. Provide all excavation, trenching, tunneling and backfilling required for the mechanical work.
- C. Provide all pumping and/or well pointing required for the mechanical work.
- D. Provide foundations if required to support underground piping.
- E. Backfill all excavations with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.

3.15 FLASHING

- A. Provide all flashing required for mechanical work. Refer to Division 07 Specification Sections.

3.16 LUBRICATION

- A. Provide all lubrication for the operation of the equipment until acceptance by the Owner. Contractor is responsible for all damage to bearings up to the date of acceptance of the equipment. Protect all bearings and shafts during installation. Thoroughly grease steel shafts to prevent corrosion. Provide covers as required for proper protection of all motors and other equipment during construction.

3.17 FILTERS

- A. Provide and maintain filters in air handling systems throughout the construction period and prior to final acceptance of the building. Do not run air handling equipment, without all prefilters and final filters as specified.
- B. Immediately prior to final building acceptance by the Owner, Contractor shall:
 - 1. Replace all disposable type air filters with new units.

3.18 CLEANING

- A. Each Mechanical Trade shall be responsible for removing all debris daily as required to maintain the work area in a neat, orderly condition.
- B. After equipment, steam, condensate and HVAC water piping systems have been completed and tested, each entire system shall be cleaned and flushed. Refer to Division 23 Section "Piping Systems Flushing and Chemical Cleaning" for requirements. Provide temporary bypass piping and fittings, temporary valves and strainers, temporary water make-up piping with approved means of backflow prevention, and temporary pumps as needed to perform specified flushing and cleaning requirements.
- C. Flushing, cleaning, and disinfection of domestic water piping is specified in Division 22 Section "Domestic Water Piping."
- D. Exterior surfaces of all piping, ductwork and equipment shall be wiped down to remove excess dirt and debris prior to concealment by Architectural Trades work.
- E. Upon completion of work in each respective area, clean and protect work. Just prior to final acceptance, perform additional cleaning as necessary to provide clean equipment and areas to the Owner.

END OF SECTION 20 05 10

SECTION 20 05 13

MOTORS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	1
1.04 QUALITY ASSURANCE	2
1.05 COORDINATION	2
PART 2 PRODUCTS	2
2.01 MANUFACTURERS	2
2.02 MOTOR REQUIREMENTS	3
2.03 MOTOR CHARACTERISTICS	3
2.04 POLYPHASE MOTORS	3
2.05 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS	6
2.06 SINGLE-PHASE MOTORS	6
2.07 ENCLOSED CONTROLLERS	6
2.08 ENCLOSED SWITCHES AND CIRCUIT BREAKERS	6
2.09 FUSES	6
2.10 FIELD QUALITY CONTROL	6
2.11 ADJUSTING	7
2.12 CLEANING	7

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 20 "Mechanical General Requirements."
 2. Division 20 Section "Mechanical Vibration Controls" for mounting motors and vibration isolation devices.
 3. Division 20 Section "Variable Frequency Controllers".
 4. Division 21, 22, and 23 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.
 5. Division 26 Section "Enclosed Switches and Circuit Breakers".
 6. Division 26 Section "Enclosed Controllers".
 7. Division 26 Section "Fuses".

1.02 SUMMARY

- A. This Section includes basic requirements for factory-installed and field-installed motors.

1.03 DEFINITIONS

- A. ABMA: American Bearing Manufacturers Association. (Formerly AFBMA: Anti-Friction Bearing Manufacturers Association.)
- B. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- C. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.
- D. Packaged Self Contained Equipment: Equipment which includes component mechanical and electrical equipment mounted on common bases, skids or frames or in common enclosures with internal control and power wiring factory installed and ready to accept a single electrical service connection. Provide the equipment complete with enclosed controllers, main disconnect switches, control transformers, control devices, wiring and accessories as required.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL), acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.05 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:
 - 1. Compatible with the following:
 - a. Magnetic controllers.
 - b. Multispeed controllers.
 - c. Reduced-voltage controllers.
 - d. Solid-state controllers.
 - e. Variable frequency controllers.
 - 2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
 - 3. Matched to torque and horsepower requirements of the load.
 - 4. Matched to ratings and characteristics of supply circuit and required control sequence.
- B. Coordinate electrical scope of work to be provided by Division 20, 21, 22, and 23 with this Section, related Division 20, 21, 22, and 23 Specifications, Division 26 Specifications and the Drawings.
- C. Electrical work provided under Division 20, 21, 22, and 23: Furnish UL Listed components in accordance with this section, Division 26, and applicable NEMA and NEC (ANSI C 1) requirements. Provide wiring, external to electrical enclosures, in conduit.
- D. Furnished, installed and wired under Division 20, 21, 22, and 23 unless otherwise indicated:
 - 1. Disconnected components in packaged self-contained equipment that are so constructed that components of wiring must be disconnected for shipment and reconnected after installation.
- E. Furnished and installed under Division 20, 21, 22, and 23 and wired under Division 26 unless otherwise indicated:
 - 1. Motors required for mechanical equipment
 - 2. Packaged Self-Contained Equipment:
 - a. Provide equipment ready to accept a single electrical service connection.
 - b. For equipment with remote mounted control panels, provide mounting of the control panel and external wiring from the control panel to the package self-contained equipment.
 - 3. Variable frequency controllers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Dayton.
 - 2. Toshiba Intl.
 - 3. Baldor Electric/Reliance.
 - 4. Rockwell Automation/Allen-Bradley.
 - 5. Nidec Motor Corporation; U.S. Electrical Motors.
 - 6. Regal Beloit/GE Commercial Motors.
 - 7. Regal Beloit/Leeson.
 - 8. Regal Beloit/Marathon.
 - 9. Siemens.

2.02 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory-installed and field-installed motors except as follows:
 - 1. Different ratings, performance, or characteristics for a motor are specified in another Section.
 - 2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.
 - 3. Submersible motors integral to pumps and excluded from NEMA and EISA standards.
- B. Electrical Power Supply Characteristics: Coordinate electrical system requirements with Division 26.
- C. Electrical Power System Characteristics: As scheduled on the Drawings.
- D. Electrical Connection: Conduit connection boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide screwed conduit connection in end frame.

2.03 MOTOR CHARACTERISTICS

- A. Motors 1/2 HP and Larger: Three phase, unless otherwise indicated.
- B. Motors Smaller Than 1/2 HP: Single phase, unless otherwise indicated.
- C. Frequency Rating: 60 Hz.
- D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- F. 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.
- G. Brake Horsepower Input: Shall not exceed 90 percent of the rated motor horsepower.
- H. Enclosure: Open dripproof (ODP) for motors installed indoors and out of the airstream. Totally-enclosed fan-cooled (TEFC) for motors installed outdoors or within the airstream.

2.04 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Fire pump motors, C-face motors, JP and JM frame motors, and motors over 200 horsepower shall be energy efficient motors. Efficiency of the motor shall be determined based on the NEMA MG1. The minimum efficiencies, nominal efficiencies and shall meet or exceed Table 12-11.

	1800 RPM OPEN DRIP-PROOF MOTORS 4 POLE		1800 RPM ENCLOSED MOTORS 4 POLE	
	NOMINAL EFF	MINIMUM EFF	NOMINAL EFF	MINIMUM EFF
HP				
1	82.5	81.5	82.5	81.5
1.5	84	82.5	84	82.5
2	84	82.5	84	82.5
3	86.5	85.5	87.5	86.5
5	87.5	86.5	87.5	86.5
7.5	88.5	87.5	89.5	88.5
10	89.5	88.5	89.5	88.5
15	91	90.2	91	90.2

1800 RPM OPEN DRIP-PROOF MOTORS 4 POLE			1800 RPM ENCLOSED MOTORS 4 POLE	
HP	NOMINAL EFF	MINIMUM EFF	NOMINAL EFF	MINIMUM EFF
20	91	90.2	91	90.2
25	91.7	91	92.4	91.7
30	92.4	91.7	92.4	91.7
40	93	92.4	93	92.4
50	93	92.4	93	93
60	93.6	93	93.6	93
75	94.1	93.6	94.1	93.6
100	94.1	93.6	94.5	94.1
125	94.5	94.1	94.5	94.1
150	95	94.5	95	94.5
200	95	94.5	95	94.5

1200 RPM OPEN DRIP-PROOF MOTORS 6 POLE			3600 RPM OPEN DRIP-PROOF MOTORS 2 POLE	
HP	NOMINAL EFF	MINIMUM EFF	NOMINAL EFF	MINIMUM EFF
1	80	78.5	--	--
1.5	84	82.5	82.5	81.5
2	85.5	84	84	82.5
3	86.5	85.5	84	82.5
5	87.5	86.5	85.5	84
7.5	88.5	87.5	85.5	86.5
10	90.2	89.5	88.5	87.5
15	90.2	89.5	89.5	88.5
20	91	90.2	90.2	89.5
25	91.7	91	91	90.2
30	92.4	91.7	91	90.2
40	93	92.4	91.7	91
50	93	93	92.4	91.7
60	93.6	93	93	92.4
75	93.6	93	93	92.4
100	94.1	93.6	93	92.4
125	94.1	93.6	93.6	93
150	94.5	94.1	93.6	93
200	94.5	94.1	94.5	94.1

- C. Efficiency: Motors 1 horsepower to 200 horsepower shall be premium efficient motors meeting requirements of NEMA Premium Efficiency Motor Program. Efficiency of the motor shall be determined based on the NEMA MG1. The nominal efficiencies shall meet or exceed Table 12-12.

Nominal Efficiencies For "NEMA Premium™" Induction Motors
 Rated 600 Volts or Less (Random Wound)

Open Drip-Proof				Totally Enclosed Fan-Cooled		
HP	<u>6-pole</u>	<u>4-pole</u>	<u>2-pole</u>	<u>6-pole</u>	<u>4-pole</u>	<u>2-pole</u>
1	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2	87.5	86.5	85.5	88.5	86.5	85.5
3	88.5	89.5	85.5	89.5	89.5	86.5
5	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7
30	93.6	94.1	91.7	93.0	93.6	91.7
40	94.1	94.1	92.4	94.1	94.1	92.4
50	94.1	94.5	93.0	94.1	94.5	93.0
60	94.5	95.0	93.6	94.5	95.0	93.6
75	94.5	95.0	93.6	94.5	95.4	93.6
100	95.0	95.4	93.6	95.0	95.4	94.1
125	95.0	95.4	94.1	95.0	95.4	95.0
150	95.4	95.8	94.1	95.8	95.8	95.0
200	95.4	95.8	95.0	95.8	96.2	95.4

Nominal Efficiencies For "NEMA Premium™" Induction Motors
Rated Medium Volts for 5kV or Less (Form Wound)

Open Drip-Proof				Totally Enclosed Fan-Cooled		
HP	<u>6-pole</u>	<u>4-pole</u>	<u>2-pole</u>	<u>6-pole</u>	<u>4-pole</u>	<u>2-pole</u>
250	95.0	95.0	94.5	95.0	95.0	95.0
300	95.0	95.0	94.5	95.0	95.0	95.0
350	95.0	95.0	94.5	95.0	95.0	95.0
400	95.0	95.0	94.5	95.0	95.0	95.0
450	95.0	95.0	94.5	95.0	95.0	95.0
500	95.0	95.0	94.5	95.0	95.0	95.0

- D. Stator: Copper windings, unless otherwise indicated.
 - 1. Multispeed motors shall have separate winding for each speed.
- E. Rotor: Squirrel cage, unless otherwise indicated.
- F. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 120,000 hours. Calculate bearing load with NEMA minimum V- belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- G. Temperature Rise: Match insulation rating, unless otherwise indicated.
- H. Insulation: Class F, unless otherwise indicated.
- I. Code Letter Designation:
 - 1. Motors 10 HP and Larger: NEMA starting Code (KVA Code) F or G.
 - 2. Motors Smaller Than 10 HP: Manufacturer's standard starting characteristic.
- J. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.
 - 1. Finish: Gray enamel.
- K. Sound Level: Not to exceed NEMA MG-1 12.54.

2.05 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. 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. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
- B. Shaft Grounding: Provide a means to protect motor from common mode currents.
 - 1. Required for:
 - a. Motors used with variable frequency controllers.
 - b. Motors 100 HP and larger.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Electro Static Technology, Inc.; Aegis SGR Conductive Microfiber.
- C. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:
 - 1. Measure winding resistance.
 - 2. Read no-load current and speed at rated voltage and frequency.
 - 3. Measure locked rotor current at rated frequency.
 - 4. Perform high-potential test.

2.06 SINGLE-PHASE MOTORS

- A. Type: One of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split-phase start, capacitor run.
 - 3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
- C. 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.
- D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

2.07 ENCLOSED CONTROLLERS

- A. Provide enclosed controllers in accordance with requirements specified in Division 26 Section "Enclosed"

2.08 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- A. Provide enclosed switches and circuit breakers in accordance with requirements specified in Division 26

2.09 FUSES

- A. Provide fuses in accordance with requirements specified in Division 26 Section "Fuses".

2.10 FIELD QUALITY CONTROL

- A. All three phase motors 1/2 HP and above shall be tested by the Testing Agency.
- B. Prepare for acceptance tests as follows:
 - 1. Check motor nameplates for horsepower, speed, phase and voltage.
 - 2. Check coupling alignment and shaft end play.
 - 3. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
 - 4. Test interlocks and control features for proper operation.
 - 5. Verify that current in each phase is within nameplate rating.
- C. Testing: Perform the following field quality-control testing:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
2. Jog motor as required to verify proper phase and shaft rotation. Immediately after start-up, check bearing temperature and smooth operation. Take current reading at full load using a clamp-on ammeter. If ammeter reading is over the rated full load current, determine reason for discrepancy and take necessary corrective actions. Record all readings, motor nameplate data and overload heater data.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

2.11 ADJUSTING

- A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

2.12 CLEANING

- A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 20 05 13

SECTION 20 05 29 HANGERS AND SUPPORTS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 DEFINITIONS	1
1.03 PERFORMANCE REQUIREMENTS	1
1.04 SUBMITTALS	2
1.05 QUALITY ASSURANCE	2
PART 2 PRODUCTS	2
2.01 MANUFACTURERS	2
2.02 HANGER ROD MATERIAL	2
2.03 STEEL PIPE HANGERS AND SUPPORTS	2
2.04 TRAPEZE PIPE HANGERS	2
2.05 METAL FRAMING SYSTEMS	3
2.06 METAL INSULATION SHIELDS	3
2.07 PIPE COVERING PROTECTION SADDLES	3
2.08 THERMAL-HANGER SHIELDS	3
2.09 FASTENER SYSTEMS	4
2.10 ROOF MOUNTED PIPING SUPPORTS	4
2.11 EQUIPMENT SUPPORTS	5
2.12 MISCELLANEOUS MATERIALS	5
PART 3 EXECUTION	5
3.01 HANGER AND SUPPORT APPLICATIONS	5
3.02 HANGER AND SUPPORT INSTALLATION	6
3.03 EQUIPMENT SUPPORTS	9
3.04 METAL FABRICATIONS	9
3.05 ADJUSTING	9
3.06 PAINTING	9

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 2. Division 21 Section "Fire-Suppression Piping" for pipe hangers for fire-protection piping.
 3. Division 20 Section "Mechanical General Requirements."
 4. Division 20 Section "Basic Mechanical Materials and Methods."
 5. Division 20 Section "Mechanical Vibration Controls" for vibration isolation devices.
 6. Division 20 Section "Pipe Expansion Fittings and Loops" for pipe guides and anchors.
 7. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.02 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. MFMA: Metal Framing Manufacturers Association.

1.03 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Metal framing systems. Include Product Data for components.
 - 3. Pipe stands. Include Product Data for components.
- C. Welding certificates.

1.05 QUALITY ASSURANCE

- A. MSS Standards: Pipe hangers, supports, and accessories shall comply with the following:
 - 1. MSS SP-58, Pipe Hangers and Supports – Materials, Design and Manufacture.
 - 2. MSS SP-69, Pipe Hangers and Supports – Selection and Application.
 - 3. MSS SP-89, Pipe Hangers and Supports – Fabrication and Installation Practices.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
 - 5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 HANGER ROD MATERIAL

- A. Threaded, hot rolled, steel rod conforming to ASTM A 36 or A575.
 - 1. Rod continuously threaded.
 - 2. Use of rod couplings is prohibited.

2.03 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-69, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article, and schedules and details on the Drawings for where to use specific hanger and support types.
 - 1. Hangers and Supports for Fire Protection Piping: UL listed or FMG approved.
- B. Manufacturers:
 - 1. Anvil International, Inc.
 - 2. B-Line by Eaton.
 - 3. Carpenter & Paterson, Inc.
 - 4. Hilti USA.
 - 5. ERICO International Corp.
 - 6. PHD Manufacturing, Inc.
- C. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.04 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.05 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 - 1. Anvil International, Inc.; Anvil-Strut.
 - 2. B-Line by Eaton.
 - 3. Power-Strut Div.; Tyco International, Ltd.
 - 4. Unistrut Corp.; Tyco International, Ltd.
 - 5. Hilti USA.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- E. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.06 METAL INSULATION SHIELDS

- A. Manufacturers:
 - 1. Anvil International, Inc.
 - 2. B-Line by Eaton.
 - 3. Carpenter & Paterson, Inc.
 - 4. ERICO International Corp.
 - 5. PHD Manufacturing, Inc.
- B. Description: MSS SP-69, Type 40, protective shields. Shields shall span an arc of 180 degrees.
- C. Shield Dimensions for Pipe: Not less than the following:
 - 1. NPS 1/4 to NPS 2: 12 inches long and 0.048 inch thick.

2.07 PIPE COVERING PROTECTION SADDLES

- A. Manufacturers:
 - 1. Anvil International, Inc.
 - 2. B-Line by Eaton.
 - 3. Carpenter & Paterson, Inc.
 - 4. ERICO International Corp.
 - 5. PHD Manufacturing, Inc.
- B. Description: MSS SP-69, Type 39A and Type 39B, for suspension of insulated hot pipe where heat losses are to be kept to a minimum.
 - 1. Saddles shall match insulation thickness.
 - 2. Saddle length: 12 inches.
 - 3. Furnish with center rib for pipe sized NPS 12 and larger.

2.08 THERMAL-HANGER SHIELDS

- A. Manufacturers:
 - 1. B-Line by Eaton.
 - 2. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 - 3. Rilco Manufacturing Company, Inc.
 - 4. American Mechanical Insulation Sales Inc. (AMIS).
 - 5. ERICO International Corp.
 - 6. Value Engineered Products, Inc.
- B. Description: Manufactured assembly consisting of insulation insert encased in 360 degree sheet metal shield.
 - 1. Minimum Compressive Strength of Insert Material:
 - a. 100-psig- for sizes smaller than NPS 6.
 - b. 600-psig- for sizes NPS 6 and larger.

- C. Insulation-Insert Material for Cold Piping: Full 360 degree, water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Full 360 degree, water-repellent treated, ASTM C 533, Type I calcium silicate.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
- F. Include carbon steel ASTM A36 load distribution plates as required by load, pipe movement, hanger style, and hanger spacing.
- G. Thermal-Hanger Shields for Flexible Foamed Elastomeric Insulated Piping:
 - 1. Manufacturer:
 - a. B-Line by Eaton/Armacell; Armafix IPH.
 - 2. Insulation-Insert Material for Copper Piping with Flexible Foamed Elastomeric Insulation: Use the following:
 - a. Flexible foamed elastomeric, ASTM 534, Type I-Tubular Grade 1 with PUR/PIP support inserts.
- H. Thermal-Hanger Shields for Small Diameter Piping:
 - 1. Manufacturer:
 - a. Hydra-Zorb Company; Klo-Shure Insulation Couplings.
 - 2. Insulation-Insert Material for Small Diameter Piping with Flexible Foamed Elastomeric or Glass Fiber Insulation: Use the following:
 - a. Rigid Hytel thermoplastic insulation coupling designed for use with pipe or tube NPS 1-1/2 and smaller, and insulation from 3/8 inch to 1-1/2 inch thick.

2.09 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line by Eaton.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.
- B. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application. Exception: Do not use chemical fasteners to support hanger systems for fire protection piping.
 - 1. Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. MKT Fastening, LLC.
 - d. Powers Fasteners.
 - 2. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - 3. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
 - 4. Washer and Nut: Zinc-coated steel.

2.10 ROOF MOUNTED PIPING SUPPORTS

- A. Low, Fixed-Height, Single-Base Stand: Assembly of base and horizontal member, and pipe support, for roof installation without membrane penetration.
 - 1. Manufacturers:
 - a. B-Line by Eaton; Dura-Blok.
 - b. Eco Support Products.

- c. ERICO International Corp.
 - d. MIRO Industries; Conduit and Condensate Supports.
 - e. Portable Pipe Hangers.
 - 2. Base: Plastic, stainless steel, or recycled rubber.
 - 3. Horizontal Member: Cadmium-plated-steel or galvanized-steel strut designed for use with standard strut clamps and accessories.
- B. Low, Adjustable-Height, Single-Base Stand: Assembly of base, horizontal member, and adjustable vertical members, and pipe support, for roof installation without membrane penetration.
 - 1. Manufacturers:
 - a. B-Line by Eaton; Dura-Blok.
 - b. Eco Support Products.
 - c. ERICO International Corp.
 - d. MIRO Industries; Conduit and Condensate Supports.
 - e. Portable Pipe Hangers.
 - 2. Base: Plastic, stainless steel, or recycled rubber.
 - 3. Horizontal Member: Cadmium-plated-steel or galvanized-steel strut designed for use with standard strut clamps and accessories.
 - 4. Vertical Members: Threaded, hot rolled, steel rod conforming to ASTM A 36 or A575 with cadmium plated nuts and washers. Rod continuously threaded.

2.11 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.12 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, 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

3.01 HANGER AND SUPPORT APPLICATIONS

- A. Refer to application schedules on the Drawings.
- B. For insulated pipe, oversize hanger elements to accommodate insulation thickness.
- C. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- D. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- E. Use hangers and supports with galvanized, metallic coatings for outdoor applications or where exposed to outdoor conditions.
- F. Use hangers and supports with plastic coating, or galvanized metallic coatings for applications in corrosive atmospheres.
- G. Use metal framing, with plastic coating, or galvanized metallic coatings for metal framing in corrosive atmospheres.
- H. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- I. Use padded hangers for piping that is subject to scratching.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. MSS Type 8 or spring type to meet system requirements.

- K. 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.
- L. Concrete Structure Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Anchor Devices, Concrete and Masonry: in accordance with Group I, Group II, Type 2, Class 2, Style 1 and Style 2, Group III and Group VIII or FS FF-S-325A. Furnish cast-in floor type equipment anchor devices with adjustable positions. Furnish built in anchor devices for masonry, unless otherwise approved by the Architect. Powder actuated anchoring devices shall not be used to support any mechanical systems components.
 - 2. Inserts, Concrete: TYPE 18 or 19. When applied to loads equivalent to piping in sizes NPS 2 and larger, and where otherwise required by imposed loads, a one foot length of 1/2 inch NPS 4 reinforcing rod shall be inserted and wired through wing slots. Proprietary type continuous inserts may be proposed and shall be submitted for approval.
 - 3. Use mechanical-expansion anchors where required in concrete construction.
 - 4. Use chemical fasteners where required in concrete construction.
- M. Steel Frame Structure Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Beam Clamps:
 - a. Center Loading: TYPE 21, 28, 29 and 30, unless otherwise indicated. Type 27 shall be allowed to support single pipes NPS 6 size or smaller only.
 - b. "C" Clamps: Type 19, 20 or 23, for supporting single pipes NPS 2-1/2 size or smaller only. Use of "C" clamps, or beam clamps of "C" pattern, or any modification thereof, is prohibited for supporting multiple pipes or pipes larger than NPS 2-1/2.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Use spring supports and sway braces TYPES 48, 49, 50, 51, 52, 53, 54, 55 or 56. For specific points:
 - a. Provide spring supports at point of support where vertical movement will occur.
 - b. For light loads and vertical movement less than 1/4 inch, TYPES 48 or 49 spring cushion supports.
 - c. For vertical movements in excess of 1/4 inch but less than 1/2 inch, TYPES 51, 52 or 53 variable spring supports shall be used, loaded to not more than 75 percent of published load rating.
 - d. For vertical movements of 1/2 inch and more, TYPES 54, 55 and 56 constant support spring hangers.
 - e. Sway braces; TYPE 50.
 - f. Variable spring hangers in accordance with referenced MSS Standards with "medium" allowable load change.
- O. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Steel 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 building structural frame.

- B. Provide necessary piping and equipment supporting elements including: building structure attachments, supplementary steel, hanger rods, stanchions and fixtures, vertical pipe attachments, horizontal pipe attachments, anchors, guides, spring supports in accordance with the referenced codes, standards, and requirements specified. Support piping and equipment from building structure, not from roof deck, floor slab, other pipe, duct or equipment.
- C. At connections between piping systems, hangers and equipment of dissimilar metals, insulate, using dielectric insulating material, nonferrous piping against direct contact with the building steel by insulating the contact point of the hanger and pipe or the hanger and building steel. Test each point of dielectric insulation with an ohm meter to ensure proper isolation of dissimilar materials. Test shall be observed by the Owner's Representative and/or Architect.
- D. Use copper plated or plastic coated supporting element in contact with copper tubing or glass piping.
- E. File and paint cut ends and shop or field prime paint supporting element components.
- F. Hang piping parallel with the lines of the building, unless otherwise indicated. Route piping in an orderly manner and maintain gradient. Space piping and components so a threaded pipe fitting may be removed between adjacent pipes and so there will be not less than 1/2 inch of clear space between finished surfaces and piping. Arrange hangers on adjacent parallel service lines in line with each other.
- G. Flange loads on connected equipment shall not exceed 75 percent of maximum allowed by equipment manufacturer. Flange loads in liquid containing systems shall be checked in the presence of the Architect when piping is full of liquid. No flange load is allowed on pumps, vibration isolated equipment or flexible connectors.
- H. Spring supports, within specified limitations: Constant support type, where necessary to avoid transfer of load from support to support or onto connected equipment; otherwise, variable support type located at points subject to vertical movement.
- I. Incorporate pipe anchors into piping systems to maintain permanent pipe positions. Install alignment guides for the piping adjacent to and on each side of pipe expansion loops and expansion joints to maintain alignment.
- J. Where necessary, brace piping and supports against reaction, sway and vibration.
- K. Do not hang piping from concrete joist pans, floor decks, roof decks, equipment, ductwork, or other piping.
- L. Install turnbuckles, swing eyes and clevises to accommodate temperature changes, pipe accessibility, and adjustment for load pitch. Rod couplings are not acceptable.
- M. Install hangers and supports for piping at intervals specified, at locations not more than 3 feet from the ends of each runout, not more than 3 feet from connections to equipment, and not over 25 percent of specified interval from each change in direction of piping and for concentrated loads such as valves, etc.
- N. Base the load rating for pipe support elements on loads imposed by insulated weight of pipe filled with water. The span deflection shall not exceed slope gradient of pipe.
- O. If structural steel, roofs, or tunnels will allow support spacing greater than that shown above, Contractor shall submit proposed support system along with structural calculations documenting the allowance of such spacing, in accordance with ANSI, B31.1, and MSS Guidelines.
- P. Support vertical risers independently of connected horizontal piping whenever practical, with supports at the base and at intervals to accommodate system range of load with thermal conditions. Support vertical risers at each floor penetration for piping in shafts or chases. Guide for lateral stability. Fit horizontal piping connected to moving risers with two spring supports connected adjacent to riser, spaced according to required hanger spacing.
- Q. For risers at temperatures of 100 deg F or less place riser clamps under fittings. Support carbon steel pipe at each operating level or floor and at not more than 15-foot intervals for pipe 2 inches and smaller, and at not more than 20 foot intervals for pipe 2-1/2 inches and larger.

- R. After the piping systems have been installed, tested and placed in satisfactory operation, firmly tighten hanger rod nut and jam nut and upset threads to prevent movement of fasteners.
- S. Attach pipe anchors and pipe alignment guides to the building structure where indicated. If not indicated, the method used is optional to the Contractor, subject to approval by the Architect. In the case of structural steel, make attachment by clamping in accordance with the American Institute of Steel Construction Specification for the Design, Fabrication and Erection of Structural Steel for Building.
- T. Attach supporting elements connected to structural steel columns to preclude vertical slippage and cascading failure.
- U. Attach pipe hangers and other supporting elements to roof purlins and trusses at panel points.
- V. Where eccentric loading beam clamps are approved and where other work is supported by similar eccentric loading support element from the same structural member, locate eccentric loading support elements to minimize structural member torsion load.
- W. Limit the location of supporting elements for piping and equipment, when supported from roof, to panel points of the bar joists.
- X. Building structure shall not be reinforced except as approved by the Architect in writing.
- Y. Use approved cast-in-place inserts or built-in anchors for attachment to concrete structure. Size inserts and anchors for the total applied load with a safety factor in accordance with applicable codes but in no case less than 5. Coordinate installation of all imbedded items in accordance with manufacturer's instructions. Position anchorage and imbedded items as indicated and/or where required and support against displacement during placing of concrete. Cutting or repositioning of concrete beam or girder or reinforcing steel to accommodate inserts will not be allowed. Provide removable closures in imbedded device openings to prevent entry of concrete.
- Z. Support piping and equipment from concrete building frame, not from roof or floor slabs unless otherwise indicated.
- AA. Use cast-in-place inserts in concrete beams and girders. Drilled anchors/wedge type inserts shall be used on vertical surfaces only. Coordinate with structural engineer.
- BB. Attach piping supports to the side of concrete beams and concrete joist. Provide supplementary support steel as required. Cast-in-place or drilled anchors will not be permitted in the bottom of concrete beams and concrete joist.
- CC. Attach piping supports to the side of concrete beams or concrete joist. Where intermediate hangers are required to meet the hanger spacing schedule, the Contractor may propose attachment of intermediate pipe supports to the bottom of the concrete slab pending submittal of a satisfactory pull out test. The Contractor shall submit pull out test criteria, pull out test results, proposed hanger detail and hanger point loads to the Architect for written approval.
- DD. 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 above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- EE. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- FF. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- GG. Roof-Mounting Pipe and Equipment Stand Installation:

1. Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 2. Curb or Rail Mounting Type Stands: Assemble components or fabricate stand and mount on permanent, stationary roof curb or rail. Refer to Division 07 Section "Roof Accessories" for curb and rail installation.
 3. Maintain support manufacturer's recommended spacing.
- HH. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- II. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- JJ. Install hangers and supports to allow controlled thermal 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.
- KK. Install lateral bracing with pipe hangers and supports to prevent swaying.
- LL. 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.
- MM. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- NN. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- OO. Refer to individual piping sections for hanger spacing and hanger rod sizes.

3.03 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- 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 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 contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.06 PAINTING

- A. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 20 05 29

SECTION 20 05 53
MECHANICAL IDENTIFICATION

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUBMITTALS	1
1.03 QUALITY ASSURANCE	1
1.04 COORDINATION	1
PART 2 PRODUCTS	1
2.01 MANUFACTURERS	1
2.02 EQUIPMENT IDENTIFICATION DEVICES	2
2.03 PIPING IDENTIFICATION DEVICES	2
2.04 DUCT IDENTIFICATION DEVICES	2
2.05 WARNING TAGS	2
PART 3 EXECUTION	3
3.01 APPLICATIONS, GENERAL	3
3.02 EQUIPMENT IDENTIFICATION	3
3.03 PIPING IDENTIFICATION	4
3.04 DUCT IDENTIFICATION	4
3.05 WARNING-TAG INSTALLATION	5
3.06 ADJUSTING	5
3.07 CLEANING	5
3.08 SCHEDULES	5

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."

1.02 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.

1.03 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME (ANSI) A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.04 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 location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified:
 - 1. Seton.
 - 2. Brady.

3. EMED.
4. Craftmark.
5. Brimar Industries, Inc.
6. Marking Services Inc. (MSI).
7. Kolbi Pipe Marker Co.

2.02 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
 1. Terminology: Match schedules as closely as possible.
 2. Data:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

2.03 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 1. Colors: Comply with ASME (ANSI) A13.1, unless otherwise indicated.
 2. Type and Size of Letters: Comply with ANSI A13.1, unless otherwise indicated.
 3. Legends: Spelled out in full or commonly used and accepted abbreviations.
 4. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
 5. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
 6. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

2.04 DUCT IDENTIFICATION DEVICES

- A. Duct Markers: Vinyl, 2-inch minimum character height, with permanent pressure sensitive adhesive. Include direction and quantity of airflow, air handling unit or fan number, and duct service (such as supply, return, and exhaust).

2.05 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: 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

3.01 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 20, 21, 22, and 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.02 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
 - 1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - 2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - 3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - 4. Fans, blowers, primary balancing dampers, and mixing boxes.
 - 5. Packaged HVAC central-station and zone-type units.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
 - 1. Letter Size: Minimum 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.
 - 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 - 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Fire department hose valves and hose stations.
 - c. Meters, gages, thermometers, and similar units.
 - d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - g. Fans, blowers, primary balancing dampers, and mixing boxes.
 - h. Packaged HVAC central-station and zone-type units.
 - i. Tanks and pressure vessels.
 - j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
 - 1. Identify mechanical equipment with equipment markers in the following color codes:
 - a. Green: For cooling equipment and components.
 - b. Yellow: For heating equipment and components.
 - c. Orange: For combination cooling and heating equipment and components.
 - d. Brown: For energy-reclamation equipment and components.
 - 2. Letter Size: Minimum 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.
 - 3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 - 4. Include signs for the following general categories of equipment:

- a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - e. Fans, blowers, primary balancing dampers, and mixing boxes.
 - f. Packaged HVAC central-station and zone-type units.
 - g. Tanks and pressure vessels.
 - h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- D. Install access panel markers with screws on equipment access panels.
- E. Area Served: Equipment serving different areas of a building other than where the equipment is installed shall be permanently marked in a manner that, in addition to identifying the equipment as specified in this Section, also identifies the area it serves.

3.03 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
- 1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.
 - 2. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed 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 nonaccessible 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 markers.
- C. Underground Pipe Markers: Install 6 to 8 inches below finished grade, directly above buried pipe.

3.04 DUCT IDENTIFICATION

- A. Install engraved duct markers with permanent adhesive on air ducts in the following color codes:
- 1. Refer to Schedule.
 - 2. ASME (ANSI) A13.1 Colors and Designs: For hazardous material exhaust.
 - 3. Letter Size: Minimum 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.
- B. Identify ductwork with vinyl markers and flow direction arrows.
- C. Locate markers at air handling units, each side of floor and wall penetrations, near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.05 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

3.06 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.07 CLEANING

- A. Clean faces of mechanical identification devices and glass frames of valve schedules.

3.08 SCHEDULES

- A. Pipe marker color abbreviations shall be per drawing abbreviations.
- B. Pipe marker coding shall be per ASME A13.1 requirements.

END OF SECTION 20 05 53

SECTION 20 07 00
MECHANICAL INSULATION

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	1
1.04 INDOOR PIPING INSULATION SYSTEMS DESCRIPTION	2
1.05 INDOOR DUCT AND PLENUM INSULATION SYSTEMS DESCRIPTION	2
1.06 SUBMITTALS	2
1.07 QUALITY ASSURANCE	2
1.08 DELIVERY, STORAGE, AND HANDLING	2
1.09 COORDINATION	2
1.10 SCHEDULING	3
PART 2 PRODUCTS	3
2.01 INSULATION MATERIALS, GENERAL REQUIREMENTS	3
2.02 PIPE INSULATION MATERIALS	3
2.03 DUCTWORK INSULATION MATERIALS	3
2.04 INSULATING CEMENTS	4
2.05 ADHESIVES	4
2.06 MASTICS	4
2.07 SEALANTS	5
2.08 FACTORY-APPLIED JACKETS	5
2.09 TAPES	6
2.10 SECUREMENTS	6
PART 3 EXECUTION	7
3.01 EXAMINATION	7
3.02 PREPARATION	7
3.03 COMMON INSTALLATION REQUIREMENTS	7
3.04 PENETRATIONS	8
3.05 GENERAL PIPE INSULATION INSTALLATION	9
3.06 GLASS-FIBER AND MINERAL WOOL PIPE INSULATION INSTALLATION	10
3.07 DUCT AND PLENUM INSULATION INSTALLATION	10
3.08 FINISHES	11

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."
 - 2. Division 20 Section "Basic Materials and Methods."
 - 3. Division 20 Section "Hanger and Supports" for thermal hanger shield inserts.
 - 4. Division 22 Section "Plumbing Fixtures: for protective shielding guards.
 - 5. Division 23 Section "Metal Ducts" for duct liners.

1.02 SUMMARY

- A. This Section includes mechanical insulation for pipe, duct, and equipment.

1.03 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. FSP: Foil, scrim, polyethylene.

- D. PVC: Polyvinyl Chloride.
- E. PVDC: Polyvinylidene chloride.
- F. SSL: Self-sealing lap.

1.04 INDOOR PIPING INSULATION SYSTEMS DESCRIPTION

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are scheduled on the Drawings, or identified for each piping system and pipe size range.

1.05 INDOOR DUCT AND PLENUM INSULATION SYSTEMS DESCRIPTION

- A. Acceptable indoor duct and plenum insulation materials and thicknesses are scheduled on the Drawings.

1.06 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
 - 1. ESR Report: For fire-rated grease duct insulation.
- B. Shop Drawings: Show details for the following:
 - 1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Attachment and covering of heat tracing inside insulation.
 - 3. Insulation application at pipe expansion joints for each type of insulation.
 - 4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Application of field-applied jackets.
 - 7. Application at linkages of control devices.
 - 8. Field application for each equipment type
 - 9. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.07 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Ductwork Maximum Temperature Limits: Based on ASTM C 411 test procedures.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Prior to installation, protect insulation from exposure to water and from physical damage. Prior to installation, store insulation in manufacturer's original packaging.

1.09 COORDINATION

- A. Coordinate size and location of supports, hangers, and pre-insulated pipe shields/supports specified in Division 20 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork 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.

1.10 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

2.01 INSULATION MATERIALS, GENERAL REQUIREMENTS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Adhesives used shall be fire resistant in their dry states and UL listed.

2.02 PIPE INSULATION MATERIALS

- A. Glass-Fiber, Preformed Pipe Insulation, Type I:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000 Pipe Insulation.
 - c. Manson Insulation Inc.; Alley-K.
 - d. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 deg F Materials: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
- B. Mineral-Wool, Preformed Pipe Insulation, Type II:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Rock Wool Manufacturing Company; Delta PC and PF.
 - c. Roxul Inc.; 1200 Pipe Insulation.
 - 2. Type II, 1200 deg F Materials: Mineral wool fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

2.03 DUCTWORK INSULATION MATERIALS

- A. Blanket Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. CertainTeed Corp.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap FSK.
 - e. Owens Corning; All-Service Duct Wrap.

2.04 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Insulco, Division of MFS, Inc.; Triple I.
 - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Insulco, Division of MFS, Inc.; SmoothKote.
 - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
 - c. Rock Wool Manufacturing Company; Delta One Shot.

2.05 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to it and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Armacell LCC; 520 Adhesive.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - c. RBX Corporation; Rubatex Contact Adhesive.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Childers Products, H.B. Fuller Company; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 - f. Vimasco Corporation.
- D. ASJ Adhesive, and PVDC 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 products specified.
 - a. Childers Products, H.B. Fuller Company; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Red Devil, Inc.; Celulon Ultra Clear.
 - e. Speedline Corporation; Speedline Vinyl Adhesive.

2.06 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Childers Products, H.B. Fuller Company; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96, 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, 59 percent by volume and 71 percent by weight.
 - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Childers Products, H.B. Fuller Company; CP-10.
 - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
 - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
 - d. Marathon Industries, Inc.; 550.
 - e. Mon-Eco Industries, Inc.; 55-50.
 - f. Vimasco Corporation; WC-1/WC-5.
 - 2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 200 deg F.
 - 4. Solids Content: 63 percent by volume and 73 percent by weight.
 - 5. Color: White.

2.07 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Childers Products, H.B. Fuller Company; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
 - 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: Aluminum.
- B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Childers Products, 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.

2.08 FACTORY-APPLIED JACKETS

- A. Insulation systems indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.09 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - 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 and UL listed.
 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 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. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.

2.10 SECUREMENTS

- A. Bands:
 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - a. PABCO-Childers Metals; ITW Insulation Systems; Pab-Bands and Fabstraps.

- b. RPR Products, Inc.; Bands.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
- 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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. 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.

3.03 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and 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 the 4 o'clock or 8 o'clock position on 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 as 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 thermal hanger 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 thermal hanger 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 the 4 o'clock or 8 o'clock position on the 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 as recommended by insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness. Where compression of insulation is possible, fabricate/install insulation per manufacturer's recommendations.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.04 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 Below-Grade 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:
1. Terminate ductwork insulation at angle closure of fire damper sleeves.
 2. Install pipe insulation continuously through penetrations of fire-rated walls and partitions.
 - a. Firestopping is specified in Division 07 Section "Through-Penetration Firestop Systems."
- F. Insulation Installation at Floor Penetrations:
1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at angle closure of fire damper sleeves.
 2. Pipe: Install insulation continuously through floor penetrations.
 - a. Seal penetrations through fire-rated assemblies according to Division 07 Section "Through-Penetration Firestop Systems."

3.05 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible Elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. 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.

3.06 GLASS-FIBER AND MINERAL WOOL PIPE INSULATION INSTALLATION

- 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 but 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 PVC fitting covers when available.
 2. When PVC fitting covers are not available, install preformed pipe insulation to outer diameter of pipe flange:
 - a. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - b. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with fiberglass or mineral wool blanket insulation as specified for system.
 3. 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 PVC fitting covers when available.
 2. When PVC fitting covers 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 PVC fitting covers when available.
 2. When PVC fitting covers 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.

3.07 DUCT AND PLENUM INSULATION INSTALLATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions. Adhesive may be omitted from top surface of horizontal rectangular ducts.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.08 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system specified in Division 09 painting Sections.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

END OF SECTION 20 07 00

SECTION 21 11 00
FIRE-SUPPRESSION SYSTEM

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	2
1.03 DEFINITIONS	2
1.04 SYSTEM DESCRIPTIONS	2
1.05 PERFORMANCE REQUIREMENTS	2
1.06 SUBMITTALS	2
1.07 QUALITY ASSURANCE	3
1.08 COORDINATION	3
1.09 EXTRA MATERIALS	3
PART 2 PRODUCTS	4
2.01 MANUFACTURERS	4
2.02 STANDARD-WEIGHT BLACK STEEL PIPE AND FITTINGS	4
2.03 SCHEDULE 10 BLACK STEEL PIPE AND FITTINGS	4
2.04 SPRINKLER SPECIALTY FITTINGS	5
2.05 LISTED FIRE-PROTECTION VALVES	5
2.06 UNLISTED GENERAL-DUTY VALVES	7
2.07 ALARM CHECK VALVES	7
2.08 AUTOMATIC (BALL DRIP) DRAIN VALVES	7
2.09 SPRINKLERS	7
2.10 FIRE DEPARTMENT CONNECTIONS	8
2.11 ALARM DEVICES	8
2.12 PRESSURE GAGES	9
PART 3 EXECUTION	9
3.01 PREPARATION	9
3.02 EXAMINATION	9
3.03 PIPING APPLICATIONS, GENERAL	9
3.04 SPRINKLER SYSTEM PIPING APPLICATIONS	9
3.05 VALVE APPLICATIONS	10
3.06 JOINT CONSTRUCTION	10
3.07 WATER-SUPPLY CONNECTION	10
3.08 PIPING INSTALLATION	10
3.09 VALVE INSTALLATION	11
3.10 SPRINKLER APPLICATIONS	11
3.11 SPRINKLER INSTALLATION	11
3.12 FIRE DEPARTMENT CONNECTION INSTALLATION	11
3.13 CONNECTIONS	11
3.14 LABELING AND IDENTIFICATION	12
3.15 FIELD QUALITY CONTROL	12
3.16 CLEANING AND PROTECTION	12
3.17 DEMONSTRATION	13

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Provisions of Division 20 Section "Mechanical General Requirements" apply to this Section.
- C. Related Sections include the following:
 1. Division 10 Section "Fire-Protection Specialties" for cabinets and fire extinguishers.
 2. Division 20 Section "Basic Mechanical Materials and Methods."

3. Division 20 Section "Hangers and Supports."
4. Division 28 Section "Fire Alarm" for alarm devices not specified in this Section.

1.02 SUMMARY

- A. This Section includes water-based fire-suppression systems inside the building.

1.03 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. High-Pressure Piping System: Fire-suppression piping system designed to operate at working pressure higher than standard 175 psig.
- C. PE: Polyethylene plastic.
- D. Underground Service-Entrance Piping: Underground service piping below the building.
- E. Hose Connection: Valve with threaded outlet matching fire hose coupling thread for attaching fire hose.
- F. Hose Station: Hose connection, fire hose rack, and fire hose.
- G. Working Plans: Documents, including drawings, calculations, and material specifications prepared according to NFPA 13 and NFPA 14 for obtaining approval from authorities having jurisdiction.

1.04 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.

1.05 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Fire-suppression sprinkler system design shall be approved by 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.
 - a. Upholstering Plants: Extra Hazard, Group 1.
 2. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm/sq. ft. over 1500-sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
 3. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
 - b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
 - c. Extra-Hazard Occupancies: 500 gpm for 90 to 120 minutes.
- D. Water velocity in the piping system shall not exceed the following:
 1. Underground mains: 16 ft./sec.
 2. Aboveground mains: 20 ft./sec.
 3. Sprinkler branch lines: 20 ft./sec.

1.06 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: Include plans, elevations, sections, details, and attachments to other work.
 1. Wiring Diagrams: For power, signal, and control wiring.

- C. 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.
- D. 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. HVAC hydronic piping.
 - 3. Items penetrating finished ceiling include the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
- E. Qualification Data: For qualified Installer and professional engineer.
- F. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, and the Owner's insurance underwriter including hydraulic calculations, if applicable.
 - 1. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification number (SIN) or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.
- G. Welding certificates.
- H. Fire-hydrant flow test report.
- I. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- J. Field quality-control reports.
- K. Operation and Maintenance Data: For [standpipe] [standpipe and sprinkler] [sprinkler] specialties to include in operation and maintenance manuals.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- C. The provisions and requirements of the NFPA and the Owner's insurance underwriter constitute mandatory minimum requirements for the work of this Section.
- D. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."

1.08 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.09 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, 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 on Project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 STANDARD-WEIGHT BLACK STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends, and with factory applied antimicrobial coating on inner wall of pipe.
 - 1. Cast-Iron Threaded Flanges: ASME B16.1.
 - 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 - 3. Gray-Iron Threaded Fittings: ASME B16.4.
 - 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
 - 5. Steel Threaded Couplings: ASTM A 865.
- B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, and with factory applied antimicrobial coating on inner wall of pipe.
 - 1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 - 2. Steel Flanges and Flanged Fittings: ASME B16.5.
- C. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed, square-cut- or roll- grooved ends, and with factory applied antimicrobial coating on inner wall of pipe.
 - 1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.; Model 7401.
 - 2) Tyco Fire & Building Products; Grinnell Mechanical Products; Model 577 or 772.
 - 3) Victaulic Co. of America; Style 005 or 009.
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.

2.03 SCHEDULE 10 BLACK STEEL PIPE AND FITTINGS

- A. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13 specified wall thickness in NPS 6 to NPS 10, and with factory applied antimicrobial coating on inner wall of pipe.
 - 1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 - 2. Steel Flanges and Flanged Fittings: ASME B16.5.
- B. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10; with factory- or field-formed, roll-grooved ends, and with factory applied antimicrobial coating on inner wall of pipe.
 - 1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.; Model 7401.
 - 2) Tyco Fire & Building Products; Grinnell Mechanical Products; Model 577 or 772.
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.

- c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.

C. Refer to Division 20 Section "Mechanical General Requirements."

2.04 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have **[250-psig minimum] [300-psig]** working-pressure rating if fittings are components of high-pressure piping system.
- B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
 - 1. Manufacturers:
 - a. Tyco Fire & Building Products LP.
 - b. Fire-End and Croker Corp.
 - c. Viking Corp.
 - d. Victaulic Co. of America.
- C. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
 - 1. Manufacturers:
 - a. Elkhart Brass Mfg. Co., Inc.
- D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
 - 1. Manufacturers:
 - a. AGF Manufacturing Co.
 - b. Tyco Fire & Building Products LP.
 - c. G/J Innovations, Inc.
 - d. Triple R Specialty of Ajax, Inc.
- E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
 - 1. Manufacturers:
 - a. CECA, LLC.
 - b. Merit.
- F. Dry-Pipe-System Fittings: UL listed for dry-pipe service.

2.05 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Valves shall have pressure rating if valves are components of high-pressure piping system.
- B. Gate Valves with Wall Indicator Posts:
 - 1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
 - 2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with [operating wrench] [hand wheel], extension rod, locking device, and cast-iron barrel.
 - 3. Manufacturers:
 - a. McWane, Inc.; Kennedy Valve Div.
 - b. NIBCO.
 - c. Crane Co.; Crane Valve Group; Stockham Valves.
- C. Ball Valves: Comply with UL 1091, except with ball instead of disc.
 - 1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
 - 2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
 - 3. NPS 3: Ductile-iron body with grooved ends.
 - 4. Manufacturers:

- a. NIBCO.
 - b. Victaulic Co. of America.
- D. Butterfly Valves: UL 1091.
 - 1. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:
 - 1) McWane, Inc.; Kennedy Valve Div.
 - 2) Mueller Company.
 - 3) NIBCO.
 - 4) Tyco Fire & Building Products.
 - 5) Victaulic Co. of America.
- E. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
 - 1. Manufacturers:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Tyco Fire & Building Products.
 - d. Hammond Valve.
 - e. McWane, Inc.; Kennedy Valve Div.
 - f. Mueller Company.
 - g. NIBCO.
 - h. Crane Co.; Crane Valve Group; Stockham Valves.
 - i. Victaulic Co. of America.
 - j. Watts Water Technologies, Inc.; Watts Regulator Co.
- F. Gate Valves: UL 262, OS&Y type.
 - 1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Crane Co.; Crane Valve Group; Crane Valves.
 - 2) Hammond Valve.
 - 3) NIBCO.
 - 2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.
 - a. Manufacturers:
 - 1) McWane, Inc.; Clow Valve Co.
 - 2) Crane Co.; Crane Valve Group; Crane Valves.
 - 3) Crane Co.; Crane Valve Group; Jenkins Valves.
 - 4) Hammond Valve.
 - 5) Milwaukee Valve Company.
 - 6) Mueller Company.
 - 7) NIBCO.
- G. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
 - 1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch.
 - 2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.
 - a. Manufacturers:
 - 1) Milwaukee Valve Company.
 - 2) NIBCO.
 - 3) Victaulic Co. of America.
 - 3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:
 - 1) Tyco Fire & Building Products LP.
 - 2) McWane, Inc.; Kennedy Valve Div.
 - 3) Milwaukee Valve Company.
 - 4) NIBCO.

- 5) Victaulic Co. of America.

2.06 UNLISTED GENERAL-DUTY VALVES

- A. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.
- B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- C. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.
- D. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.07 ALARM CHECK VALVES

- A. General Requirements:
 - 1. Standard: UL listed or FMG approved.
 - 2. Pressure Rating:
 - a. Standard-Pressure Valves: 175 psig minimum.
 - 3. Body Material: Cast or ductile iron.
 - 4. Size: Same as connected piping.
 - 5. End Connections: Flanged or grooved.
- B. Manufacturers:
 - 1. Reliable Automatic Sprinkler Co., Inc.
 - 2. Tyco Fire & Building Products.
 - 3. Viking Corp.
 - 4. Victaulic Co. of America.
- C. Description: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber and fill-line attachment with strainer.
 - 1. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

2.08 AUTOMATIC (BALL DRIP) DRAIN VALVES

- A. General:
 - 1. Standard: UL 1726.
 - 2. Pressure Rating: 175 psig minimum.
 - 3. Type: Automatic draining, ball check.
 - 4. Size: NPS 3/4.
 - 5. End Connections: Threaded.
- B. Manufacturer:
 - 1. Reliable Automatic Sprinkler Co., Inc.
 - 2. Tyco Fire & Building Products.

2.09 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have pressure rating if sprinklers are components of high-pressure piping system.
- B. Manufacturers:
 - 1. Reliable Automatic Sprinkler Co., Inc.
 - 2. Tyco Fire & Building Products.
 - 3. Victaulic Co. of America.
 - 4. Viking Corp.
- C. Automatic Sprinklers:
 - 1. With heat-responsive glass bulb element complying with the following:

- a. UL 199, for nonresidential applications.
 - b. UL 1767, for early-suppression, fast-response applications.
 - c. Orifice: 1/2 inch, with discharge coefficient K between 5.3 and 5.8.
 - d. Orifice: 17/32 inch, with discharge coefficient K between 7.4 and 8.2.
- D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for 165 deg F "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
- E. Sprinkler types, features, and options as follows:
- 1. Concealed ceiling sprinklers, including cover plate.
 - 2. Sidewall sprinklers.
 - 3. Upright sprinklers.
- F. Sprinkler Finishes: Chrome plated, bronze, and painted.
- G. Special Coatings: Wax, lead, and corrosion-resistant paint.
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers. Escutcheons listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.
- 1. Ceiling Mounting: Chrome-plated steel, 2 piece, with 3/4-inch vertical adjustment.
 - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler. Sprinkler guards listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.

2.10 FIRE DEPARTMENT CONNECTIONS

- A. Manufacturers:
- 1. Elkhart Brass Mfg. Co., Inc.
 - 2. Potter-Roemer; Fire-Protection Div.
- B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR & STANDPIPE."
- 1. Type: Flush, with two inlets and square or rectangular escutcheon plate.
 - 2. Finish: Rough chrome-plated.

2.11 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch- diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.
1. Manufacturers:
- a. AFAC Inc.
 - b. Firematic Sprinkler Devices, Inc.
 - c. Globe Fire Sprinkler Corporation.
 - d. Reliable Automatic Sprinkler Co., Inc.
 - e. Tyco Fire & Building Products.
- C. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
1. Manufacturers:
- a. Potter Electric Signal Company.
 - b. System Sensor.

- D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
1. Manufacturers:
 - a. Potter Electric Signal Company.
 - b. System Sensor.

2.12 PRESSURE GAGES

- A. Manufacturers:
1. AMETEK, Inc.; U.S. Gauge.
 2. Ashcroft Inc.
 3. Marsh Bellofram.
 4. Viking Corp.
 5. Weiss Instruments, Inc.
- B. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gage with range of [0 to 250 psig minimum] [0 to 300 psig].
1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
 2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

PART 3 EXECUTION

3.01 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.02 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 thicknesses, 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.

3.03 PIPING APPLICATIONS, GENERAL

- A. Flanges, flanged fittings, unions, nipples, grooved-joint couplings, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- B. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.

3.04 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Wet-Pipe Sprinklers: Use the following:

Pipe Type	1 1/2" & Smaller	2"	2 1/2" – 3 1/2"	4"	5" – 6"
Standard weight steel, threaded fittings	YES	YES	YES	YES	NO
Standard weight steel, locking fittings	NO	NO	NO	NO	NO
Standard weight steel, grooved fittings	NO	NO	YES	YES	YES
Standard weight steel, welded fittings	NO	YES	YES	YES	YES
Schedule 10 steel, welded fittings	NO	YES	YES	YES	YES

Pipe Type	1 ½" & Smaller	2"	2 ½" – 3 ½"	4"	5" – 6"
Schedule 10 steel, grooved fittings	NO	NO	YES	YES	YES

3.05 VALVE APPLICATIONS

- A. The following requirements apply:
 - 1. Listed Fire-Protection Valves: UL listed or FMG approved for applications where required by NFPA 13.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - 2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - b. Throttling Duty: Use ball or globe valves.

3.06 JOINT CONSTRUCTION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.
- C. 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.
- D. Use of saddle style tees is not acceptable.
- E. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
 - 1. All grooved couplings, fittings, gaskets, valves, and specialties shall be the product of a single manufacturer.
 - 2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
 - 3. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.

3.07 WATER-SUPPLY CONNECTION

- A. Connect fire-suppression piping to building's interior water distribution piping.
- B. Install shutoff valve, double-check, detector-assembly backflow preventor, pressure gage, drain, and other accessories indicated at connection to water distribution piping.

3.08 PIPING INSTALLATION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- C. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- D. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- E. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- F. Install sprinkler piping with drains for complete system drainage.
- G. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

- H. Install drain valves on standpipes.
- I. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- J. Install alarm devices in piping systems.
- K. Hangers and Supports: Comply with NFPA 13 for hanger materials.
 - 1. Install standpipe system piping according to NFPA 14.
 - 2. Install sprinkler system piping according to NFPA 13, except use of "C" clamps, or beam clamps of "C" pattern, or any modification thereof, is prohibited for supporting pipes larger than NPS 2-1/2.
 - 3. Refer to Division 20 Section "Hangers and Supports" for additional requirements.
- L. 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.
- M. Fill wet-pipe sprinkler system piping with water.

3.09 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty 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.

3.10 SPRINKLER APPLICATIONS

- A. Use the following sprinkler types:
 - 1. Rooms without Ceilings: Upright sprinklers.
 - 2. Rooms with Suspended Ceilings: concealed sprinklers.
 - 3. Wall Mounting: Sidewall sprinklers.
 - 4. Sprinkler Finishes:
 - a. 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; white polyester finish in natatoriums.
 - b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 - 5. Sprinkler Guards: For exposed sprinkler heads subject to damage.

3.11 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.

3.12 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire department connections in vertical wall.
- B. Install ball drip valve at each check valve for fire department connection.

3.13 CONNECTIONS

- A. Install piping adjacent to equipment to allow service and maintenance.
- B. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.

- C. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- D. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- E. Electrical Connections: Power wiring and fire alarm wiring are specified in Division 26.
- F. Connect alarm devices to fire alarm.
- G. Ground equipment according to Division 26 Section "Grounding and Bonding."
- H. Connect wiring according to Division 26 Section "Conductors and Cables."
- I. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.14 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 20 Section "Mechanical Identification."

3.15 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 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. 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. Verify that equipment hose threads are same as local fire department equipment.
 - 6. Test each double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- C. Verify that specified tests of piping are complete.
- D. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- E. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
- F. Verify that potable-water supplies have correct types of backflow preventers.
- G. Energize circuits to electrical equipment and devices.
- H. Coordinate with fire alarm tests. Operate as required.
- I. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.16 CLEANING AND PROTECTION

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.
- C. Protect sprinklers from damage until Substantial Completion.

3.17 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 20 Section "Mechanical General Requirements."

END OF SECTION 21 11 00

SECTION 22 05 23 GENERAL DUTY VALVES FOR PLUMBING

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	1
1.04 SUBMITTALS	2
1.05 QUALITY ASSURANCE	2
1.06 DELIVERY, STORAGE, AND HANDLING	2
PART 2 PRODUCTS	2
2.01 VALVES, GENERAL	2
2.02 BRONZE BALL VALVES	3
2.03 GENERAL SERVICE BUTTERFLY VALVES	3
2.04 BRONZE CHECK VALVES	4
2.05 IRON SWING CHECK VALVES	4
2.06 SPRING-LOADED, CENTER-GUIDED LIFT-DISC (SILENT) CHECK VALVES	5
2.07 DRAIN VALVES	5
2.08 SOURCE QUALITY CONTROL	5
PART 3 EXECUTION	5
3.01 EXAMINATION	5
3.02 VALVE INSTALLATION	6
3.03 JOINT CONSTRUCTION	6
3.04 ADJUSTING	6

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 13 21 fire-suppression piping and fire pump Sections for fire-protection valves.
 2. Division 20 Section "Mechanical Identification" for valve tags and charts.
 3. Division 22 piping Sections for specialty valves applicable to those Sections only.
 4. Division 23 Section "General-Duty Valves for HVAC" for HVAC valves.
 5. Division 23 Section "Temperature Controls" for control valves and actuators.

1.02 SUMMARY

- A. This Section includes valves for general plumbing applications. Refer to piping Sections for specialty valve applications.

1.03 DEFINITIONS

- A. The following are standard abbreviations for valves:
 1. CWP: Cold working pressure.
 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
 3. NBR: Acrylonitrile-butadiene rubber.
 4. NRS: Nonrising stem.
 5. OS&Y: Outside screw and yoke.
 6. PTFE: Polytetrafluoroethylene plastic.
 7. RPTFE: Reinforced polytetrafluoroethylene plastic.
 8. SWP: Steam working pressure.
 9. TFE: Tetrafluoroethylene plastic.
 10. WOG: Water, oil, and gas.

1.04 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
 - 1. Certification that products for use in potable water systems comply with NSF 61 and NSF 372.

1.05 QUALITY ASSURANCE

- A. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

1.06 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

2.01 VALVES, GENERAL

- A. Isolation valves are scheduled on the Drawings. For other general plumbing valve applications, use the following:
 - 1. Shutoff Service: Ball, or butterfly valves.
 - 2. Throttling Service: Ball, or butterfly valves.
 - 3. Pump Discharge: Spring-loaded, lift-disc check valves; and bronze lift check valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- D. For valves not indicated in the Application Schedules, select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for condenser water, heating hot water, steam, and steam condensate services.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged, solder-joint, or threaded ends.
 - 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.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
 - 7. For Grooved-End Systems: Valve ends may be grooved.

- E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted unless otherwise noted. Wetted surfaces of valves contacted by consumable water shall contain not more than 0.25 percent weighted average lead content.
 - 1. Exceptions:
 - a. Valves in pumped sanitary systems.
 - b. Valves in pumped storm systems.
 - c. Drain valves.
 - d. Valves in general air or vacuum systems.
 - e. Valves in irrigation systems.
 - f. Valves in non-potable water systems.
 - g. Valves in other plumbing systems not intended for human consumption.
- F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- G. Valve Actuators:
 - 1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
 - 2. Gear Drive Operator: For quarter-turn valves NPS 8 and larger.
 - 3. Handwheel: For valves other than quarter-turn types.
 - 4. Lever Handle: For quarter-turn valves NPS 6 and smaller.
- H. Extended Valve Stems: On insulated valves.
- I. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- J. Valve Grooved Ends: AWWA C606.
- K. Solder Joint: With sockets according to ASME B16.18.
 - 1. Caution: Disassemble valves when soldering, as recommended by the manufacturer, to prevent damage to internal parts.
- L. Threaded: With threads according to ASME B1.20.1.
- M. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE BALL VALVES

- A. Bronze Ball Valves, General: MSS SP-110 and have bronze body complying with ASTM B 584, except for Class 250 which shall comply with ASTM B 61, full-depth ASME B1.20.1 threaded or solder ends, and blowout-proof stems.
- B. Two-Piece, Regular Port Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel ball and stem, reinforced TFE seats, blow-out-proof stem, with adjustable stem packing, soldered or threaded ends; and 150 psig SWP and 600-psig CWP ratings.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; by Conbraco Industries, Inc.; Series 70LF-140/240.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company; Model UPBA100S/150S.
 - d. NIBCO INC.; Models S-580-70-66-LF/T-580-70-66-LF.
 - e. Watts Water Technologies, Inc.

2.03 GENERAL SERVICE BUTTERFLY VALVES

- A. General: MSS SP-67, for bubble-tight shutoff, extended-neck for insulation, disc and lining suitable for potable water, unless otherwise indicated, and with the following features:
 - 1. Full lug, and grooved valves shall be suitable for bi-directional dead end service at full rated pressure without the use or need of a downstream flange.
 - 2. Valve sizes NPS 2 through NPS 6 shall have lever lock operator; valve sizes NPS 8 and larger shall have weatherproof gear operator.

- B. Lug-Style (Single-Flange) Size NPS 2-1/2 through NPS 12 , 200-psig CWP Rating, Aluminum-Bronze Disc, EPDM Seat, Ferrous-Alloy Butterfly Valves: Full-lug type with ductile-iron body, Type 416 stainless-steel stem, copper bushing, aluminum-bronze disc, and molded-in EPDM seat (liner).
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; by Conbraco Industries, Inc.; Series 143 and Series LD145.
 - b. Bray International, Inc.
 - c. DeZurik.
 - d. Forum Energy Technologies; ABZ Valve.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.; LD-2000-3/5.
 - h. Pentair Valves & Controls; Keystone.
 - i. Tyco Flow Control; Grinnell Flow Control.
 - j. Watts Water Technologies.
- C. Grooved-End Butterfly Valves with EPDM-Encapsulated Ductile-Iron Disc: Ductile-iron body with grooved or shouldered ends and polyamide coating inside and outside; Type 416 stainless-steel stem, PTFE bronze sintered on steel bushing, and 300-psig CWP Rating for Valves NPS 2 through NPS 8, 200 psig CWP Rating for Valves NPS 10 through NPS 12.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. NIBCO INC.; Model GD-4765-3/5.
 - c. Tyco Fire & Building Products; Grinnell Mechanical Products.
 - d. Victaulic Co. of America.

2.04 BRONZE CHECK VALVES

- A. Bronze Check Valves, General: MSS SP-80.
- B. Class 125, Bronze, Swing Check Valves with Bronze Disc: ASTM B-62 bronze body and seat with regrinding-type bronze disc, Y-pattern design, soldered or threaded end connections, and having 200 psig CWP rating.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; by Conbraco Industries, Inc.; Model 162T-LF and 163T-LF (61YLF Series).
 - b. Milwaukee Valve Company; Model UP509/UP1509.
 - c. NIBCO INC.; Models S-413-B-LF or T-413-B-LF.
 - d. Watts Water Technologies; LFCVY/LFCVYS.

2.05 IRON SWING CHECK VALVES

- A. Iron Swing Check Valves, General: MSS SP-71.
- B. Class 125, Gray-Iron, Standard Swing Check Valves: ASTM A-126, Class B cast-iron body and bolted bonnet with flanged end connections; non-asbestos synthetic-fiber gaskets; bronze disc and seat; and having 200 psig CWP rating.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; by Conbraco Industries, Inc.; Model 910F.
 - b. Crane Co.; Crane Valves.
 - c. Crane Co.; Stockham Div.
 - d. Hammond Valve; IR1124-HI.
 - e. Milwaukee Valve Company; Model F-2974.
 - f. NIBCO INC.; Model F-918-B.
 - g. Watts Water Technologies.

- C. Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends; nonasbestos, synthetic-fiber gaskets; rubber seats; and having 250-psig CWP Rating.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mueller Co.
 - b. NIBCO, INC.; Model G-917-W.
 - c. Tyco Fire & Building Products; Grinnell Mechanical Products.
 - d. Victaulic Co. of America.

2.06 SPRING-LOADED, CENTER-GUIDED LIFT-DISC (SILENT) CHECK VALVES

- A. Lift-Disc Check Valves, General: FCI 74-1 and MIL-V-18436F, with spring-loaded, center-guided bronze disc and seat.
- B. Class 125, Wafer, Lift-Disc Check Valves: Wafer style with cast-iron body with diameter made to fit within bolt circle, and having 200 psig CWP rating.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. NIBCO INC.; Model W-910-B-LF.
 - b. Mueller Steam Specialty.
 - c. Milwaukee Valve Company.
 - d. Hammond Valve.
- C. Class 125, Globe, Flanged Lift-Disc Check Valves: Globe style with cast-iron body and flanged ends, and having 200 psig CWP rating.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. NIBCO INC.; Model F-910-B-LF.
 - b. Mueller Steam Specialty.
 - c. Milwaukee Valve Company.
 - d. Hammond Valve.

2.07 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves :
 - 1. Bronze ball valve as specified in this Section. Lead free construction is not required.
 - 2. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.08 SOURCE QUALITY CONTROL

- A. Identification: Factory label or identify lead free valves.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. 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.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. 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.
- F. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe. Butterfly valves shall be installed with stem horizontal to allow support for the disc and the cleaning action of the disc.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.03 JOINT CONSTRUCTION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.04 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 22 05 23

SECTION 22 11 16 DOMESTIC WATER PIPING

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 PERFORMANCE REQUIREMENTS	1
1.04 SYSTEMS DESCRIPTION	1
1.05 SUBMITTALS	2
1.06 QUALITY ASSURANCE	2
1.07 PROJECT CONDITIONS	2
1.08 COORDINATION	2
PART 2 PRODUCTS	2
2.01 MANUFACTURERS	2
2.02 PIPING MATERIALS	3
2.03 COPPER TUBE AND FITTINGS	3
2.04 VALVES	3
2.05 SPECIALTY VALVES	3
PART 3 EXECUTION	3
3.01 EXCAVATION	3
3.02 PIPING SYSTEM INSTALLATION	4
3.03 JOINT CONSTRUCTION	4
3.04 WATER METER INSTALLATION	4
3.05 HANGER AND SUPPORT INSTALLATION	4
3.06 CONNECTIONS	5
3.07 FIELD QUALITY CONTROL	5
3.08 ADJUSTING	6
3.09 CLEANING AND DISINFECTION	6

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 20 Section "Mechanical General Requirements."
 2. Division 20 Section "Basic Mechanical Materials and Methods" for materials and methods common to mechanical piping systems.
 3. Division 20 Section "Hangers and Supports."
 4. Division 20 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
 5. Division 22 Section "Plumbing Valves" for general duty plumbing valves.
 6. Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.

1.02 SUMMARY

- A. This Section includes domestic water piping inside the building.
- B. Water meters will be furnished and installed by utility company.

1.03 PERFORMANCE REQUIREMENTS

- A. Where not indicated on the Drawings, provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

1.04 SYSTEMS DESCRIPTION

- A. Potable and non-potable domestic water piping system materials are scheduled on the Drawing.

- B. Under-Building-Slab, Water-Service Piping on Service Side of Water Meter: Refer to Division 22 Section "Facility Water Distribution."
- C. Refer to Application Schedules on the Drawings for valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
 - 2. Drain Duty: Hose-end drain valves.
 - 3. Isolation Valves at Domestic Water Meters: Gate Valves, NPS 2 and Smaller: Class 150, bronze.
 - 4. Isolation Valves at Domestic Water Meters: Gate Valves, NPS 2-1/2 and Larger: Class 125, OS&Y, bronze-mounted cast iron.
- D. Transition and special fittings with pressure ratings at least equal to piping rating may be used unless otherwise indicated.

1.05 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. LEED Submittals:
- C. Water Samples: Specified in Part 3 "Cleaning" Article.
- D. Field quality-control test reports.

1.06 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- C. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components – Lead Content for potable domestic water piping and components.
- E. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be as recommended by the manufacturer of the grooved components.

1.07 PROJECT 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. Notify Architect and Owner no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not proceed with interruption of water service without Architect's or Owner's written permission.

1.08 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 PIPING MATERIALS

- A. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.03 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.04 VALVES

- A. General-duty plumbing valves; and drain valves are specified in Division 22 Section "Plumbing Valves."
- B. Balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."

2.05 SPECIALTY VALVES

- A. Bronze Gate Valves: MSS SP-80, with malleable-iron handwheel.
 - 1. Class 150, Rising-Stem, Bronze Gate Valves: ASTM B-62 bronze body, bonnet, and wedge, copper-silicone bronze stem, screw-in bonnet, threaded end connections; and having 300 psig CWP rating.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Crane Valve Group; Crane Valves.
 - 2) Hammond Valve.
 - 3) Milwaukee Valve Company; Model 1150.
 - 4) NIBCO INC.; Models T-131, S-134 or T-134.
 - 5) Watts Water Technologies, Inc.; Series B-3110.
- B. Cast-Iron Gate Valves: MSS SP-70, with bolted bonnet, flanged end connections, and non-asbestos packing and gasket.
 - 1. Class 125, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: ASTM A-126, Class B cast-iron body and bonnet with bronze trim, and solid-wedge disc; and having 200 psig CWP rating.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Crane Valve Group; Crane Valves.
 - 2) Hammond Valve.
 - 3) Milwaukee Valve Company; Model F-2885.
 - 4) NIBCO INC.; Model F-617-O.
 - 5) Watts Water Technologies.

PART 3 EXECUTION

3.01 EXCAVATION

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earthwork."

3.02 PIPING SYSTEM INSTALLATION

- A. Basic piping installation requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. Install sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- C. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- 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. Pressure gages are specified in Division 20 Section "Meters and Gages," and strainers are specified in Division 22 Section "Domestic Water Piping Specialties."
- E. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops.
- F. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
 - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
 - 2. Install stop-and-waste drain valves where indicated.
- G. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."
- H. Install water-pressure regulators downstream from shutoff valves. Water-pressure regulators are specified in Division 22 Section "Domestic Water Piping Specialties."
- I. Install domestic water piping level without pitch and plumb.

3.03 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."

3.04 WATER METER INSTALLATION

- A. Water meters will be furnished and installed by utility company.

3.05 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support devices are specified in Division 20 Section "Hangers and Supports." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - 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: MSS Type 49, spring cushion rolls, if indicated.
 - 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.
- B. Install supports according to Division 20 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

- E. 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.
- F. Install supports for vertical steel piping every 15 feet.
- G. Install hangers for drawn-temper 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.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Soft copper tube: Continuous support using v-shaped plastic pipe channel, maximum hanger spacing 8 feet with 3/8-inch rod.
- J. Alternate support for copper tubing NPS 3/4 and smaller: Continuous support using v-shaped plastic pipe channel, maximum hanger spacing 8 feet with 3/8-inch rod.
- K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect domestic water piping to distribution side of water meter with shutoff valve.
- C. Connect domestic water piping to existing domestic water distribution piping. Use dielectric fitting if connection dissimilar metals. Refer to Application Schedule on the Drawings and Division 20 Section "Basic Mechanical Materials and Methods" for dielectric fittings.
- D. Install piping adjacent to equipment and machines to allow service and maintenance.
- E. Connect domestic water piping to the following:
 - 1. Water Heaters: Cold-water supply 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 required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
 - 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.

3.07 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. 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:

- a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 2. 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.
 3. 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.
 4. Cap and subject piping to static water pressure of 150 psig. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.

3.08 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 flow of hot water in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 5. Remove plugs used during testing of piping and plugs used 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.

3.09 CLEANING AND DISINFECTION

- A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.
- B. Clean and disinfect potable and non-potable domestic water piping as follows:
 1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as 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. 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.

END OF SECTION 22 11 16

SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 PERFORMANCE REQUIREMENTS	1
1.03 SUBMITTALS	1
1.04 QUALITY ASSURANCE	1
PART 2 PRODUCTS	2
2.01 VACUUM BREAKERS	2
2.02 BALANCING VALVES	2
2.03 TEMPERATURE-ACTUATED WATER MIXING VALVES	3
2.04 STRAINERS FOR DOMESTIC WATER PIPING	3
2.05 WATER HAMMER ARRESTERS	3
2.06 AIR VENTS	4
PART 3 EXECUTION	4
3.01 INSTALLATION	4
3.02 CONNECTIONS	5
3.03 LABELING AND IDENTIFYING	5
3.04 FIELD QUALITY CONTROL	5
3.05 ADJUSTING	5

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."
 - 2. Division 20 Section "Basic Mechanical Materials and Methods."
 - 3. Division 20 Section "Meters and Gages" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 4. Division 22 Section "Domestic Water Piping" for water meters.
 - 5. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.02 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Flow Reports and Settings: For calibrated balancing valves.
- E. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.

- B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- C. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
 - 3. Comply with NSF 372, "Drinking Water System Components – Lead Content" for components with wetted surfaces in contact with potable water.

PART 2 PRODUCTS

2.01 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers <Insert drawing designation if any>:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. FEBCO; a Division of Watts Water Technologies, Inc.
 - c. Watts Water Technologies, Inc.; Watts Regulator Co.
 - d. Zurn Plumbing Products Group; Wilkins Div.
 - 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.

2.02 BALANCING VALVES

- A. Calibrated Balancing Valves NPS 1/2 :
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Apollo Valves; by Conbraco Industries, Inc.
 - d. Bell & Gossett; Xylem Inc.
 - e. Flo Fab Inc.
 - f. Flow Design Inc.
 - g. Griswold Controls.
 - h. NIBCO INC.
 - i. IMI Indoor Climate; Tour & Andersson.
 - j. Taco, Inc.
 - k. Watts Water Technologies, Inc.; Watts Regulator Co.
 - 2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
 - 3. Body: Dezincification resistant brass, or bronze.
 - 4. Minimum Flow Rate: 0.3 gpm.
- B. Calibrated Balancing Valves NPS 3/4 to NPS 2 :
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Apollo Valves; by Conbraco Industries, Inc.
 - d. Bell & Gossett; Xylem Inc.
 - e. Flo Fab Inc.
 - f. Flow Design Inc.
 - g. Griswold Controls.
 - h. NIBCO INC.

- i. IMI Indoor Climate; Tour & Andersson.
- j. Taco, Inc.
- k. Watts Water Technologies, Inc.; Watts Regulator Co.
- 2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
- 3. Body: Dezincification resistant brass, or bronze.
- 4. Size: Same as connected piping, but not larger than NPS 2.

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.03 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.; Model MVD (34D Series).
 - b. Bradley Corporation.
 - c. Lawler Manufacturing Company, Inc.
 - d. Leonard Valve Company; Series 170-LF and 270-LF.
 - e. Watts Water Technologies, Inc.; Powers Division; Hydroguard Series e480 and LM495.
 - f. Watts Water Technologies, Inc.; Watts Regulator Co.
 - g. Zurn Plumbing Products Group; Wilkins Div.
- 2. Standard: ASSE 1070.
- 3. Pressure Rating: 125 psig.
- 4. Type: Thermostatically controlled water mixing valve.
- 5. Material: Bronze body with corrosion-resistant interior components.
- 6. Connections: 1/2-inch union or 3/8-inch compression; with integral check valves.
- 7. Accessories: Adjustable temperature-control knob.
- 8. Outlet Temperature Range: Adjustable from 85 deg F to 120 deg F. Set at 105 deg F .
- 9. Minimum Flow Rate: 0.5 gpm.
- 10. Valve Finish: Rough bronze.

2.04 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

- 1. Manufacturers:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Keckley.
 - c. Metraflex.
 - d. Mueller Steam Specialty.
 - e. NIBCO, Inc.
 - f. Spence.
 - g. SSI Equipment, Inc.
 - h. Watts Water Technologies, Inc.
 - i. Yarway.
- 2. CWP: 200 psig minimum, unless otherwise indicated.
- 3. SWP: 125 psig minimum, unless otherwise indicated.
- 4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
- 5. End Connections: Threaded or soldered for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
- 6. Screen: Stainless steel with round perforations, unless otherwise indicated.
- 7. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.033 inch.
- 8. Drain: Pipe plug.

2.05 WATER HAMMER ARRESTERS

A. Water Hammer Arresters (Copper Tube Type):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Watts Water Technologies, Inc.; Watts Regulator Co.
 2. Standard: ASSE 1010 or PDI-WH 201.
 3. Type: Copper tube with piston.
 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.
- B. Water Hammer Arresters (Metal Bellows Type):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASSE 1010 or PDI-WH 201.
 3. Type: Precharged stainless steel bellows.
 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.
- C. Water Hammer Arresters (Custom Type):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Type: Factory precharged stainless steel pressure chamber with stainless steel bellows and non-toxic hydraulic fluid having pressure gage and air valve with cap.
 3. Size: Custom sized for application by manufacturer.

2.06 AIR VENTS

- A. Bolted-Construction Automatic Air Vents:
1. Body: Bronze.
 2. Pressure Rating: 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.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. 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 not acceptable for this application.
3. Do not install bypass piping around backflow preventers.
 4. Install strainer and soft-seated check valve upstream of backflow preventer. Exception: Fire protection backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- D. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- E. Install balancing valves in locations where they can easily be adjusted.
- F. Install temperature-actuated water mixing valves with strainers, and check stops or shutoff valves on inlets and with shutoff valve on outlet.
1. Install thermometers and water regulators if specified.
 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- G. Install Y-pattern strainers for water on supply side of each control valve, and pump.
- H. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- I. Install water hammer arresters in water piping according to PDI-WH 201.
- J. Install air vents at high points of water piping.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."
- C. Connect wiring according to Division 26 Section "Conductors and Cables."

3.03 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. Double-check backflow-prevention assemblies.
 3. Calibrated balancing valves.
 4. Primary, thermostatic, water mixing valves.
 5. Outlet boxes.
- 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 Division 20 Section "Mechanical Identification."

3.04 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
1. Test each pressure vacuum breaker and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.05 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves as follows:
1. Set calibrated balancing valves at calculated presettings.
 2. Measure flow at all stations and adjust where necessary.

3. Record settings and mark balancing devices.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 11 19

SECTION 22 13 16 SANITARY WASTE AND VENT PIPING

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 DEFINITIONS	1
1.03 PERFORMANCE REQUIREMENTS	1
1.04 SYSTEMS DESCRIPTIONS	2
1.05 SUBMITTALS	2
1.06 QUALITY ASSURANCE	2
1.07 PROJECT CONDITIONS	2
PART 2 PRODUCTS	2
2.01 MANUFACTURERS	2
2.02 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS	2
2.03 COPPER TUBE AND FITTINGS	3
2.04 SPECIALTY PIPE FITTINGS	3
PART 3 EXECUTION	4
3.01 EXCAVATION	4
3.02 PIPING SYSTEM INSTALLATION	4
3.03 JOINT CONSTRUCTION	5
3.04 SPECIALTY PIPE FITTING INSTALLATION	5
3.05 VALVE INSTALLATION	5
3.06 HANGER AND SUPPORT INSTALLATION	5
3.07 CONNECTIONS	6
3.08 IDENTIFICATION	6
3.09 FIELD QUALITY CONTROL	6
3.10 CLEANING	7

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 20 Section "Mechanical General Requirements".
 2. Division 20 Section "Basic Mechanical Materials and Methods".
 3. Division 22 Section "Drainage Piping Specialties".

1.02 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

1.03 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. Sanitary Sewer, Force-Main Piping: 125 psig.

1.04 SYSTEMS DESCRIPTIONS

- A. Sanitary waste and vent piping system materials are scheduled on the Drawing.

1.05 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

1.06 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Cast-iron soil pipe shall be marked with the collective trademark of Cast Iron Soil Pipe Institute (CISPI).
- C. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

1.07 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 Architect and 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 Architect's or Owner's written permission.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 - 1. Manufacturers:
 - a. ANACO-Husky.
 - b. Ferguson Enterprises, Inc.; ProFlo (Private labeled Ideal Clamp Products, Inc.).
 - c. Ideal Clamp Products, Inc.; a Tomkins Company.
 - d. Mission Rubber Company; a division of MCP Industries, Inc.
 - e. Tyler Pipe.
 - 2. Standards: CISPI 310.
 - 3. Description: NSF certified for compliance with CISPI 310. 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:
 - a. ANACO-Husky; SD 4000.
 - b. Clamp-All Corp; 125.
 - c. Ferguson Enterprises, Inc.; ProFlo (Private labeled Ideal Clamp Products, Inc.).
 - d. Ideal Clamp Products, Inc.; a Tomkins Company.
 - 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.

2.03 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- A. Hard Copper Tube: ASTM B 88, Types M , water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 3. 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.
- B. Hard Copper Tube: ASTM B 88, Types L , water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 3. 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.

2.04 SPECIALTY PIPE FITTINGS

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco, Inc.
 - c. Logan Clay Products Company (The).
 - d. Mission Rubber Co.
 - e. NDS, Inc.
 - f. Plastic Oddities, Inc.
 - 2. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Mission Rubber Co.
- C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers:
 - a. ANACO.
- D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.; DMD Div.
 - c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
 - d. JCM Industries, Inc.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.

2. Center-Sleeve Material: Manufacturer's standard.
 3. Gasket Material: Natural or synthetic rubber.
 4. Metal Component Finish: Corrosion-resistant coating or material.
- E. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-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.
1. Manufacturers:
 - a. SIGMA Corp.

PART 3 EXECUTION

3.01 EXCAVATION

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING SYSTEM 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. Sanitary sewer piping outside the building is specified in Division 22 Section "Sanitary Sewerage."
- C. Basic piping installation requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- F. Install underground, copper, force-main tubing according to Copper Development Association's "Copper Tube Handbook."
- G. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- H. 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."
- I. 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 2 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.
- J. 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.
- K. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 1/8-inch per foot downward in direction of flow, unless otherwise noted.
2. Horizontal Sanitary Drainage Piping: 1/8-inch per foot downward in direction of flow, unless otherwise noted.
3. Vent Piping: 1/8-inch per foot down toward vertical fixture vent or toward vent stack.
- L. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.03 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- C. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.
- D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.04 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, nonpressure 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.

3.05 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 20 Section "Valves."
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 1. Install gate or full-port ball valve for piping NPS 2 and smaller.
- 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 sewage backflow.
 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
 2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
 3. Install backwater valves in accessible locations.
 4. Backwater valves are specified in Division 22 Section "Drainage Piping Specialties."

3.06 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 20 Section "Hangers and Supports." Install the following:
 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 2. Install individual, straight, horizontal piping runs according to the following:
 - 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.
- B. Install supports according to Division 20 Section "Hangers and Supports."

- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. 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.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. 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.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect 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. 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 or sanitary manhole.
 - 2. Sewage Pumps: To sewage pump discharge.

3.08 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 20 Section "Mechanical Identification."

3.09 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

- B. 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.

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.

END OF SECTION 22 13 16

SECTION 22 13 19 DRAINAGE PIPING SPECIALTIES

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 DEFINITIONS	1
1.03 SUBMITTALS	1
1.04 QUALITY ASSURANCE	2
1.05 COORDINATION	2
PART 2 PRODUCTS	2
2.01 BACKWATER VALVES	2
2.02 CAST-IRON CLEANOUTS	2
2.03 FLOOR DRAINS	4
2.04 AIR-ADMITTANCE VALVES	4
2.05 ROOF FLASHING ASSEMBLIES	4
2.06 TRAP SEAL PROTECTION DEVICES	5
2.07 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES	5
2.08 FLASHING MATERIALS	6
PART 3 EXECUTION	6
3.01 INSTALLATION	6
3.02 CONNECTIONS	7
3.03 FLASHING INSTALLATION	7
3.04 PROTECTION	8

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 20 Section "Mechanical General Requirements."
 2. Division 20 Section "Basic Mechanical Materials and Methods."
 3. Division 22 Section "Plumbing Fixtures" for hair interceptors.

1.02 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. PUR: Polyurethane plastic.
- G. PVC: Polyvinyl chloride plastic.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories.
- B. Shop Drawings:
 1. Show fabrication and installation details for frost-resistant vent terminals.
 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Delegated-Design Submittal: For siphonic roof drainage system indicated to comply with performance requirements and design criteria, including analysis data.
- D. Field quality-control test reports.

- E. Operation and Maintenance Data: For drainage piping specialties to include in operation and maintenance manuals.

1.04 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 an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary and storm piping specialty components.

1.05 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate size and location of roof penetrations.

PART 2 PRODUCTS

2.01 BACKWATER VALVES

- A. Horizontal, Cast-Iron Backwater Valves:
 - 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. Mfr. Co.; Division of Smith Industries, Inc.; Model 7012.
 - 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: Enameled or epoxy-coated cast iron.
 - 5. Cover: Cast iron with bolted or threaded access check valve.
 - 6. End Connections: Hub and spigot or hubless.
 - 7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
 - 8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.02 CAST-IRON CLEANOUTS

- A. Size: Cleanouts shall be same nominal size as the pipe they serve up to 4 inches . For pipes larger than 4 inches nominal size, minimum size of cleanout shall be 4 inches.
- B. Exposed Cast-Iron Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.; Series 58910.
 - b. MIFAB, Inc.; C1460.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; 4510 Series.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 4. Closure: Countersunk or raised-head, brass or bronze plug with tapered threads.

C. Cast-Iron Floor Cleanouts (On-Grade Interior Floor Areas):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.; C1220-R.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 4023S-F.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M.
3. Type: Adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Not required.
6. Outlet Connection: Spigot.
7. Closure: Brass, bronze, or plastic plug with tapered threads.
8. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy with scoriated cover in service areas, and recessed cover to accept floor finish material in finished floor areas.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Medium Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

D. Cast-Iron Floor Cleanouts (Not-On-Grade Interior Floor Areas):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.; C-1100-C-R-34.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 4333C.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M.
3. Type: Adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Required.
6. Outlet Connection: Spigot.
7. Closure: Brass, bronze, or plastic plug with tapered threads.
8. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy with scoriated cover in service areas, and recessed cover to accept floor finish material in finished floor areas.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Medium Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

E. Cast-Iron Wall Cleanouts (Finished Wall Areas):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.; Model 58790-20.
 - b. MIFAB, Inc.; C1460-RD.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - g. MIFAB, Inc.

2. Standard: ASME A112.36.2M. Include wall access.
3. Body: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, drilled-and-threaded bronze or brass plug with tapered threads.
5. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.03 FLOOR DRAINS

- A. Cast-Iron Floor Drains (Toilet Rooms, Labs, and Janitor's Closet) FD-1:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Sioux Chief Manufacturing Company, Inc.; Finish Line Adjustable Drainage System.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 2005Y-A.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.6.3.
 3. Pattern: Floor drain.
 4. Body Material: Gray iron.
 5. Seepage Flange: Required.
 6. Clamping Device: Required.
 7. Outlet: Bottom.
 8. Coating on Interior and Exposed Exterior Surfaces: Enamel.
 9. Top or Strainer Material: Nickel bronze.
 10. Top of Body and Strainer Finish: Nickel bronze.
 11. Top Shape: Round, with vandal proof screws.
 12. Dimensions of Top or Strainer: 7 inch diameter.
 13. Top Loading Classification: Light Duty.
 14. Inlet Fitting: Gray iron, with spigot outlet.
 15. Barrier Type Trap-Seal Protection Device: Required.

2.04 AIR-ADMITTANCE VALVES

- A. Fixture Air-Admittance Valves:
1. Manufacturers: Subject to compliance with requirements, provide products 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.

2.05 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.

- B. Description: Manufactured assembly consisting of metal flashing collar and skirt extending at least 6 inches from pipe, with boot reinforcement and counterflashing fitting.
 - 1. Open-Top Vent Cap: Without cap.
 - 2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 - 3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.06 TRAP SEAL PROTECTION DEVICES

- A. Barrier Type Trap Seal Protection Devices:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Smith, Jay R. Mfg. Co.; Quad Close Trap Seal Device Fig. 2692.
 - b. SureSeal Manufacturing; Inline Floor Drain Trap Sealer.
 - 2. Standard: ASSE 1072-2007.
 - 3. Sealing Element: Neoprene rubber or chemically resistant elastomer.
 - 4. Size: 2 inch, 3 inch, 3-1/2 inch, or 4 inch.
 - 5. Gravity Drain Outlet Connection: Compression fit sealing gasket 80 durometer.

2.07 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

- A. Hub Outlets:
 - 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.
- B. Air-Gap Fittings:
 - 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 - 2. Body: Bronze or cast iron.
 - 3. Inlet: Opening in top of body.
 - 4. Outlet: Larger than inlet.
 - 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- C. Sleeve Flashing Device:
 - 1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
 - 2. Size: As required for close fit to riser or stack piping.
- D. Stack Flashing Fittings:
 - 1. Description: 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.
- E. Vent Caps:
 - 1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
 - 2. Size: Same as connected stack vent or vent stack.
- F. 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.
- G. 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.

2.08 FLASHING MATERIALS

- A. 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..
- 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.
- G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. 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.
- C. 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.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. 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.

- G. Install fixture air-admittance valves on fixture drain piping.
- H. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- J. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- K. Install vent caps on each vent pipe passing through roof.
- L. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- M. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- N. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- O. Install wood-blocking reinforcement for wall-mounting-type specialties.
- P. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- Q. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20, 21, 22, and 23 Sections. 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 Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.03 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. 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 counterflashing or commercially made flashing fittings, according to Division 07 Section "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.

3.04 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 14 13 STORM DRAINAGE PIPING

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 DEFINITIONS	1
1.03 PERFORMANCE REQUIREMENTS	1
1.04 SYSTEMS DESCRIPTIONS	1
1.05 SUBMITTALS	1
1.06 QUALITY ASSURANCE	2
PART 2 PRODUCTS	2
2.01 MANUFACTURERS	2
2.02 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS	2
2.03 SPECIAL PIPE FITTINGS	2
PART 3 EXECUTION	3
3.01 EXCAVATION	3
3.02 PIPING SYSTEM INSTALLATION	3
3.03 JOINT CONSTRUCTION	4
3.04 VALVE INSTALLATION	4
3.05 HANGER AND SUPPORT INSTALLATION	4
3.06 CONNECTIONS	4
3.07 FIELD QUALITY CONTROL	4
3.08 CLEANING	5

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."
 - 2. Division 20 Section "Basic Mechanical Materials and Methods."
 - 3. Division 22 Section "Drainage Piping Specialties."
 - 4. Division 22 Section "Sump Pumps."

1.02 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. LLDPE: Linear, low-density polyethylene plastic.
- C. PE: Polyethylene plastic.
- D. PVC: Polyvinyl chloride plastic.
- E. TPE: Thermoplastic elastomer.

1.03 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: 125 psig.

1.04 SYSTEMS DESCRIPTIONS

- A. Storm drainage piping system materials are scheduled on the Drawing.

1.05 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

1.06 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Cast-iron soil pipe shall be marked with the collective trademark of Cast Iron Soil Pipe Institute (CISPI).
- C. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.
- D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be as recommended by the manufacturer of the grooved components.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 - 1. Manufacturers:
 - a. ANACO-Husky.
 - b. Ferguson Enterprises, Inc.; ProFlo (Private labeled Ideal Clamp Products, Inc.).
 - c. Ideal Clamp Products, Inc.; a Tomkins Company.
 - d. Mission Rubber Company; a division of MCP Industries, Inc.
 - e. Tyler Pipe.
 - 2. Standards: CISPI 310.
 - 3. Description: NSF certified for compliance with CISPI 310. 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:
 - a. ANACO-Husky; SD 4000.
 - b. Clamp-All Corp; HI-TORQ Series.
 - c. Ferguson Enterprises, Inc.; ProFlo (Private labeled Ideal Clamp Products, Inc.).
 - d. Ideal Clamp Products, Inc.; a Tomkins Company.
 - e. Mission Rubber Company; a division of MCP Industries, Inc.
 - 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.

2.03 SPECIAL PIPE FITTINGS

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco, Inc.
 - c. Logan Clay Products Company (The).
 - d. Mission Rubber Co.
 - e. NDS, Inc.
 - f. Plastic Oddities, Inc.

2. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Mission Rubber Co.
- C. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-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.
 1. Manufacturers:
 - a. SIGMA Corp.

PART 3 EXECUTION

3.01 EXCAVATION

- A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

3.02 PIPING SYSTEM INSTALLATION

- A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Drainage."
- B. Basic piping installation requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Drainage Piping Specialties."
- D. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
- E. 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."
- F. Make changes in direction for storm 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.
- G. Lay buried building drain 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.
- H. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
 1. Building Storm Drain: 1/8-inch per foot downward in direction of flow, unless otherwise noted.
 2. Horizontal Storm-Drainage Piping: 1/8-inch per foot downward in direction of flow, unless otherwise noted.
- I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.03 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

3.04 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 20 Section "Valves."
- B. Backwater Valves: Install backwater valves in piping subject to backflow.
 - 1. Horizontal Piping: Horizontal backwater valves.
 - 2. Install backwater valves in accessible locations.
 - 3. Backwater valves are specified in Division 22 Section "Drainage Piping Specialties."

3.05 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 20 Section "Hangers and Supports." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - 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.
- B. Install supports according to Division 20 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. 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: 60 inches with 3/4-inch rod.
 - 5. NPS 8 to 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.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

3.07 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 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 to 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.

3.08 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.

END OF SECTION 22 14 13

SECTION 22 42 00 PLUMBING FIXTURES

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 DEFINITIONS	1
1.03 SUBMITTALS	2
1.04 QUALITY ASSURANCE	2
PART 2 PRODUCTS	2
2.01 HIGH EFFICIENCY TOILETS	2
2.02 TOILET FLUSHOMETERS	3
2.03 HIGH EFFICIENCY URINALS	3
2.04 HIGH EFFICIENCY URINAL FLUSHOMETERS	3
2.05 TOILET SEATS	4
2.06 LAVATORIES	4
2.07 LAVATORY FAUCETS	4
2.08 COUNTER-MOUNTING SINKS	5
2.09 SINK FAUCETS	6
2.10 FIXTURE SUPPLIES	6
2.11 PROTECTIVE SHIELDING GUARDS	6
2.12 FIXTURE SUPPORTS	7
2.13 DISPOSERS	7
PART 3 EXECUTION	7
3.01 EXAMINATION	7
3.02 INSTALLATION	8
3.03 CONNECTIONS	8
3.04 FIELD QUALITY CONTROL	9
3.05 ADJUSTING	9
3.06 CLEANING	9
3.07 PROTECTION	9

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 10 Section "Toilet and Bath Accessories."
 2. Division 20 Section "Mechanical General Requirements."
 3. Division 20 Section "Basic Mechanical Materials and Methods."
 4. Division 22 Section "Drinking Fountains and Water Coolers."
 5. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers; individual-fixture, water tempering valves; and specialty fixtures not included in this Section.
 6. Division 22 Section "Drainage Piping Specialties" for floor drains, and specialty fixtures not included in this Section.

1.02 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.03 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. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.
- D. Operation and Maintenance Data: For plumbing fixtures and trim to include in operation and maintenance manuals.

1.04 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 an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; 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. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- F. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components – Lead Content for potable domestic water piping and components.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with applicable ANSI, ASME, ASSE, ASTM, ICC, NSF, and UL standards and other requirements specified for plumbing fixtures, trim, fittings, components, and features.

PART 2 PRODUCTS

2.01 HIGH EFFICIENCY TOILETS

- A. High Efficiency Toilets, WC-1:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.; Aflow FloWise Elongated 1.6GPF.

- b. Kohler Co.; Kingston. (Base Bid)
 - c. Sloan Valve Company.
 - d. Zurn Plumbing Products Group.
- 2. Description: Wall-mounting, back-outlet, low water consumption, vitreous-china fixture designed for flushometer valve operation.
 - a. Style: Flushometer valve.
 - 1) Bowl Type: Elongated with siphon-jet design.
 - 2) Supply Spud Location: Top.
 - 3) Design Consumption: 1.6 gal./flush.
 - 4) Color: White.
 - b. Flushometer: FV-1.
 - c. Toilet Seat: TS-1.
 - d. Fixture Support: Water-closet support combination carrier.

2.02 TOILET FLUSHOMETERS

- A. Flushometers, HET-FV-1:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.; Selectronic Exposed AC 1.6 GPF.
 - b. Zurn Plumbing Products Group (Base Bid).
 - 2. Description: Flushometer for water closet fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, courtesy flush feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
 - a. Internal Design: Diaphragm or piston operation.
 - b. Style: Exposed.
 - c. Inlet Size: NPS 1.
 - d. Trip Mechanism: Hard-wired proximity sensor actuator.
 - e. Consumption: 1.6 gal./flush .
 - f. Tailpiece Size: NPS 1-1/2 and standard length to top of fixture.
 - g. Transformer: UL approved, hard-wired.

2.03 HIGH EFFICIENCY URINALS

- A. High Efficiency Urinals, UR-1:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.; Washbrook FloWise 0.125.
 - b. Kohler Co.; Bardon. (Base Bid)
 - c. Sloan Valve Company; WEUS Series.
 - d. Zurn Industries, Inc..
 - 2. Description: Wall-mounting, back-outlet, ultra-low water consumption, vitreous-china fixture designed for flushometer valve operation.
 - a. Type: High efficiency.
 - b. Strainer or Trapway: Open trapway with integral trap.
 - c. Design Consumption: 1/8 gal./flush.
 - d. Color: White.
 - e. Supply Spud Size: NPS 3/4.
 - f. Supply Spud Location: Top.
 - g. Outlet Size: NPS 2.
 - h. Flushometer: HEU-FV-1.
 - i. Fixture Support: Urinal chair carrier.

2.04 HIGH EFFICIENCY URINAL FLUSHOMETERS

- A. Flushometers, HEU-FV-1:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Standard Companies, Inc.; Selectronic Exposed AC 0.125 GPF.
 - b. Zurn Plumbing Products Group. (Base Bid)
2. Description: High efficiency flushometer for high efficiency water closet fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, courtesy flush feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
 - a. Internal Design: Diaphragm or piston operation.
 - b. Style: Exposed.
 - c. Inlet Size: NPS 3/4.
 - d. Trip Mechanism: Hard-wired proximity sensor actuator.
 - e. Consumption: 0.125 gal./flush .
 - f. Tailpiece Size: NPS 3/4 and standard length to top of fixture.
 - g. Transformer: UL approved, hard-wired.

2.05 TOILET SEATS

- A. Toilet Seats, TS-1:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bemis Manufacturing Company; 1955SSC/1955SSCT.
 - b. Centoco Manufacturing Corp.
 - c. Church Seats; 295SSC/295SSCT.
 - d. Ferguson Enterprises, Inc.; ProFlo PFTSCOF2000WH.
 - e. Olsonite Seat Company; Model 10SSC/10SSCT.
 - f. Sanderson Plumbing Products, Inc.; Beneke Div.
 - g. Zurn Plumbing Products Group; 5955STS-WH.
 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: Standard commercial.
 - f. Color: White.

2.06 LAVATORIES

- A. Lavatories, LAV-1:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.; Lucerne Model 0355.012.
 - b. Ferguson Enterprises, Inc.; ProFlo PF5504.
 - c. Kohler Co.; K 2005 Kingston. (Base Bid)
 - d. Sloan Valve Company.
 - e. Zurn Plumbing Products Group; Z5344.
 2. Description: Accessible, wall-mounting, vitreous-china fixture.
 - a. Type: With contoured back and side shields.
 - b. Size: 20 by 18 inches rectangular.
 - c. Faucet Hole Punching: Three holes, 2-inch centers.
 - d. Color: White.
 - e. Faucet: LF-1.
 - f. Water Temperature Limiting Device: Required.
 - g. Drain: Grid with offset waste.
 - h. Drain Piping: NPS 1-1/4 chrome-plated, cast-brass P-trap; NPS 1-1/4, 17 gage tubular brass waste to wall; and wall escutcheon.
 - i. Fixture Support: Lavatory with concealed arms.

2.07 LAVATORY FAUCETS

- A. Lavatory Faucets, LF-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.; Innsbrook Model 6518 VA.2AC.
 - b. Chicago Faucets; Model 115.736.21.1.
 - c. Delta Faucet Company; Model 591-LGHGMHDF with Converter or 591T Series.
 - d. Geberit Manufacturing, Inc.
 - e. Kohler Co.
 - f. Moen Commercial.
 - g. Sloan Valve Company.
 - h. Speakman Company.
 - i. Zurn Plumbing Products Group; Z6915-F-CWB. (Base Bid)
2. Description: Faucet suitable for 4 inch centers, grid strainer, and no lift rod hole.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Mounting: Deck, concealed.
 - d. Inlet(s): NPS 1/2.
 - e. Spout Outlet: Vandal proof spray, 0.5 gpm.
 - f. Operation: Sensor/Hard-wired.
 - g. Step-Down Transformers: Required.

2.08 COUNTER-MOUNTING SINKS

- A. Sinks, SK-1:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkay Manufacturing Co. (Base Bid)
 - b. Franke Consumer Products, Inc., Commercial Div.
 - c. Just Manufacturing Company.
 - d. Moen Commercial.
 2. Description: Single-bowl, counter-mounting, lay-in stainless-steel sink.
 - a. Overall Dimensions: 15 inches left to right by 17 1/2 inches front to back.
 - b. Metal Thickness: 18 gage, with sound dampened underside.
 - c. Bowl:
 - 1) Dimensions: 12 inches by 12 inches by 10 inches deep.
 - 2) Drain: Outlet for disposer as required.
 - a) Location: Centered in bowl.
 - d. Sink Faucet: SF-1.
 - e. Water Temperature Limiting Device: Not required.
 - f. Drain Piping: NPS 1-1/2 chrome-plated, cast-brass P-trap; 17 gage tubular brass waste to wall; and wall escutcheon(s).
- B. Sinks, SK-2:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkay Manufacturing Co. (Base Bid)
 - b. Franke Consumer Products, Inc., Commercial Div.
 - c. Just Manufacturing Company.
 - d. Moen Commercial.
 2. Description: Double-bowl, counter-mounting, lay-in stainless-steel sink. 3 hole faucet drilling with 4th hole for drinking water faucet.
 - a. Overall Dimensions: 33 inches left to right by 19 inches front to back.
 - b. Metal Thickness: 18 gage, with sound dampened underside.
 - c. Left Bowl:
 - 1) Dimensions: 14 inches by 14 inches by 7-1/2 inches deep.
 - 2) Drain: 3-1/2-inch grid or outlet for disposer as required.
 - a) Location: Centered in bowl.
 - d. Right Bowl:

- 1) Dimensions: 14 inches by 14 inches by 7-1/2 inches deep.
- 2) Drain: 3-1/2-inch grid.
 - a) Location: Centered in bowl.
- e. Sink Faucet: SF-1.
- f. Water Temperature Limiting Device: Not required.
- g. Drain Piping: NPS 1-1/2 chrome-plated, cast-brass P-trap; 17 gage tubular brass waste to wall; and wall escutcheon(s).

2.09 SINK FAUCETS

- A. Sink Faucets, SF-1:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Chicago Faucets; No. 201-AGN8AE3-317XKCP. (Base Bid)
 - c. Delta Faucet Company; Model 23C632-R7LS.
 - d. Kohler Co.
 - e. Moen Commercial.
 - f. Speakman Company.
 - g. T & S Brass and Bronze Works, Inc.
 - h. Zurn Plumbing Products Group; Z831C4-140.
 2. Description: Sink faucet. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Mixing Valve: Two handle.
 - d. Centers: 8 inches.
 - e. Mounting: Deck.
 - f. Handle(s): Wrist blade, 4 inches.
 - g. Operation: Noncompression, manual.
 - h. Inlet(s): NPS 1/2.
 - i. Spout Type: 70-degree restricted swing gooseneck.
 - j. Spout Outlet: Aerator.
 - 1) Aerator.
 - 2) Laminar flow or plain end for patient care areas.
 - k. Maximum Flow Rate:
 - 1) 1.5 gpm .

2.10 FIXTURE SUPPLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. BrassCraft; a Masco Company.
 2. McGuire Mfg. Co., Inc.
 3. Any of the approved plumbing fixture manufacturers.
- B. Description: Chrome-plated brass, loose-key or screwdriver angle stops with brass stems; rigid, chrome-plated copper risers; and chrome-plated wall flanges.

2.11 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers (PSG-1):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Engineered Brass Co.
 - b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
 - c. McGuire Manufacturing Co., Inc.
 - d. Plumberex Specialty Products Inc.
 - e. TCI Products; SG-200BV.
 - f. TRUEBRO, Inc.

- g. Zurn Plumbing Products Group; Z8946-3-NT.
- 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.

2.12 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Josam Company.
 - 2. MIFAB Manufacturing Inc.
 - 3. Smith, Jay R. Mfg. Co.
 - 4. Tyler Pipe; Wade Div.
 - 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 - 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Water-Closet Supports:
 - 1. Description: Combination carrier designed for wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or 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.
- C. Urinal Supports:
 - 1. Description: For wall-mounting, urinal-type fixture. Include steel uprights with feet.
 - 2. Accessible-Fixture Support: Include rectangular steel uprights.
- D. Lavatory Supports:
 - 1. Description: Lavatory carrier with concealed arms and tie rods for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
 - 2. Accessible-Fixture Support: Include rectangular steel uprights.
- E. Sink Supports:
 - 1. Description: For wall-mounting sink-type fixture. Include steel uprights with feet.
 - a. Type I, sink carrier with exposed arms and tie rods.
 - b. Type II, sink carrier with hanger plate, bear studs, and tie rod.
 - c. Type III, sink carrier with hanger plate and exposed arms.

2.13 DISPOSERS

- A. Disposers, D-1:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. In-Sink-Erator; a div. of Emerson Electric Co.
 - 2. Description: Continuous-feed, household type food-waste disposer. Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 outlet; quick-mounting, stainless-steel sink flange; antisplash guard; and combination cover/stopper.
 - a. Motor: 115-V ac, 1725 rpm, 3/4 hp with overload protection.

PART 3 EXECUTION

3.01 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.

3.02 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 counter-mounting fixtures in and attached to casework.
- F. Install fixtures level and plumb according to roughing-in drawings. Install accessible fixtures at heights required by local codes.
- G. 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: Fixtures with flushometer valves, and faucets or valves with integral stops.
- H. Install ASSE 1070 water-temperature limiting devices on supplies for lavatories and sinks that will be used for handwashing, and where specified. Refer to Division 20 Section "Domestic Water Piping Specialties."
- 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 protective shielding guards PSG-1 on exposed traps and supplies of lavatories, and sinks used for hand washing.
- 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 shower flow-control fittings with specified maximum flow rates in shower arms.
- Q. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- R. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- S. 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 20 Section "Basic Mechanical Materials and Methods."
- T. 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 7 Section "Joint Sealants."

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 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. Individual water line branches, waste lines, vents, and traps for connection to individual fixtures, fixture fittings and specialties shall be in accordance with the schedule on the Drawings.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding."
- E. Connect wiring according to Division 26 Section "Conductors and Cables."

3.04 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.05 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers 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, or cartridges of leaking and dripping faucets and stops.

3.06 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.

3.07 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 22 42 00

SECTION 22 47 00
DRINKING FOUNTAINS, WATER COOLERS, AND CUSPIDORS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 DEFINITIONS	1
1.03 SUBMITTALS	1
1.04 QUALITY ASSURANCE	1
PART 2 PRODUCTS	2
2.01 PRESSURE (ELECTRIC) WATER COOLERS	2
2.02 FIXTURE SUPPORTS	3
PART 3 EXECUTION	3
3.01 EXAMINATION	3
3.02 APPLICATIONS	3
3.03 INSTALLATION	4
3.04 CONNECTIONS	4
3.05 FIELD QUALITY CONTROL	4
3.06 ADJUSTING	4
3.07 CLEANING	4

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."
 - 2. Division 20 Section "Basic Mechanical Materials and Methods."

1.02 DEFINITIONS

- A. Accessible Drinking Fountain or Water Cooler: Fixture that can be approached and used by people with disabilities.
- B. Cast Polymer: Dense, cast-filled-polymer plastic.
- C. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.
- D. Fitting: Device that controls flow of water into or out of fixture.
- E. Fixture: Drinking fountain or water cooler.
- F. Remote Water Cooler: Electrically powered equipment for generating cooled drinking water.
- G. TDS: Total dissolved solids.
- H. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

1.03 SUBMITTALS

- A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.

- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in the U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about fixtures for people with disabilities.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. AHRI Standard: Comply with AHRI's "Directory of Certified Drinking Water Coolers" for style classifications.
- F. AHRI Standard: Comply with AHRI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with AHRI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- G. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

PART 2 PRODUCTS

2.01 PRESSURE (ELECTRIC) WATER COOLERS

- A. Water Coolers, EWC-1:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkay Manufacturing Co.; LZWS-LRPBM28K. – (Base Bid)
 - b. Halsey Taylor.
 - c. Oasis Corporation.
 - 2. Description: AHRI 1010, Type PB, pressure with bubbler, accessible, Style W, dual-height, architectural-style wall-mounting water cooler with bottle filling station.
 - a. Material: Stainless steel.
 - b. Receptor Shape: Round.
 - c. Back Panel: Stainless-steel behind receptors with ventilation grille located below receptors.
 - d. Bubblers: One for each receptor, flexible or elastomeric overmolded, with adjustable stream regulator, located on receptors.
 - e. Control: Push button.
 - f. Supply: NPS 3/8 with ball, gate, or globe valve.
 - g. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
 - h. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - 1) Capacity: 8 gph of 50 deg F cooled water from 80 deg F inlet water and 90 deg F ambient air temperature.
 - 2) Electrical Characteristics: 1/5 hp; 120-V ac; single phase; 60 Hz.
 - i. Bottle Filling Station: Recessed design constructed of 18 gage Type 300 series stainless steel and ABS plastic. Include:
 - 1) Electronic sensor for no-touch activation.
 - 2) Automatic 20-second shut-off timer.
 - 3) 1.1 gpm flow rate
 - 4) Anti-microbial protected plastic components.
 - j. Support: Refer to "Fixture Supports" Article.
- B. Water Coolers, EWC-2:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Elkay Manufacturing Co.; EZWS-ERPBM8K. – (Basis of Design)
 - b. Halsey Taylor.
 - c. Oasis Corporation.
2. Description: AHRI 1010, Type PB, pressure with bubbler, accessible, Style W, architectural-style wall-mounting water cooler with bottle filling station.
 - a. Material: Stainless steel.
 - b. Receptor Shape: Round.
 - c. Back Panel: Stainless-steel behind receptors with ventilation grille located below receptors.
 - d. Bubblers: One, flexible or elastomeric overmolded, with adjustable stream regulator, located on receptors.
 - e. Control: Push button.
 - f. Supply: NPS 3/8 with ball, gate, or globe valve.
 - g. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
 - h. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - 1) Capacity: 8 gph of 50 deg F cooled water from 80 deg F inlet water and 90 deg F ambient air temperature.
 - 2) Electrical Characteristics: 1/5 hp; 120-V ac; single phase; 60 Hz.
 - i. Bottle Filling Station: Recessed design constructed of 18 gage Type 300 series stainless steel and ABS plastic. Include:
 - 1) Electronic sensor for no-touch activation.
 - 2) Automatic 20-second shut-off timer.
 - 3) 1.1 gpm flow rate
 - 4) Anti-microbial protected plastic components.
 - j. Support: Refer to "Fixture Supports" Article.

2.02 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Josam Co.
 2. MIFAB Manufacturing, Inc.
 3. Smith, Jay R. Mfg. Co.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
 1. Type I: Hanger-type carrier with two vertical uprights.
 2. Type II: Bilevel, hanger-type carrier with three vertical uprights.
 3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

- A. Use mounting frames for recessed water coolers, unless otherwise indicated.

- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.03 INSTALLATION

- A. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
- B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 20 Section "Valves."
- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint Sealants."

3.04 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 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."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.05 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.
 - 2. Report test results in writing.

3.06 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

3.07 CLEANING

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 22 47 00

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 SUBMITTALS	1
1.04 QUALITY ASSURANCE	1
1.05 ENVIRONMENTAL REQUIREMENTS	2
PART 2 PRODUCTS	2
2.01 MANUFACTURERS	2
2.02 FAN SHAFTS	2
2.03 FAN POWER TRANSMISSION	2
2.04 SHEAVES	2
2.05 V-BELT FAN DRIVES	2
2.06 FAN DRIVE, SHAFT, AND COUPLING GUARDS	3
2.07 BELT DRIVE GUARDS	3
2.08 V-BELTS	3
2.09 V-BELT DRIVE MOTOR BASES	3
2.10 AIR HANDLING SYSTEM BALANCING PROVISIONS	4
2.11 FLEXIBLE COUPLINGS (DIRECT DRIVE)	4
2.12 MOTOR REQUIREMENTS	4
2.13 FAN BEARINGS	4
2.14 IDENTIFICATION	4
2.15 ACCESSORIES	4
PART 3 EXECUTION	4
3.01 INSTALLATION	4

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."
 - 2. Division 20 Section "Basic Mechanical Materials and Methods."
 - 3. Division 23 Section "Testing, Adjusting, and Balancing."

1.02 SUMMARY

- A. This Section includes common requirements for fans and air moving equipment.

1.03 SUBMITTALS

- A. Product Data: For the following:
 - 1. Fan bearings.
 - 2. V-belt fan drives.
 - 3. Direct drive couplings.

1.04 QUALITY ASSURANCE

- A. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- B. Fan Performance Data: AMCA Standard 210.
- C. Sound Power Level Ratings:
 - 1. Ducted Fans - Rated per AMCA 301, when tested per AMCA 300.

2. Nonducted Fans - Rated in Zones at 5 feet from acoustic center of fan rated per AMCA 301, tested per AMCA 300 and converted per AMCA 302.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate equipment for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 FAN SHAFTS

- A. Fan Shafts: Ground from solid cold rolled steel, and proportioned to run at least 25 percent below the first critical speed.

2.03 FAN POWER TRANSMISSION

- A. V-Belt Type Fan Drives: In accordance with Engineering Standard Specification for Drives Using Multiple V-Belts, sponsored by the Mechanical Power Transmission Association and the Rubber Manufacturer's Association.
- B. A given manufacturer's V-belt drive, as applied to specific equipment provided under the Contract, shall conform to the equipment manufacturer's published recommendations, except as otherwise specified.
- C. Base horsepower rating of drive on minimum pitch diameter of small sheave.
- D. Locate belt drives outboard of bearings. Align drive and driven shafts by the four-point method.
- E. Adjust belt tension in accordance with the manufacturer's recommendations.
- F. Perform alignment and final belt tensioning in the presence of the Architect.

2.04 SHEAVES

- A. Furnish sheaves of machined cast iron or carbon steel, bushing type of fixed bore, secured to the shaft by key and keyway.
- B. For all constant speed fans at or above 2 inches of total static pressure, Contractor shall provide and install two sets of fixed sheaves. First set shall be installed for initial start-up and shall be based on scheduled data. The second set shall be installed after system balance is complete and shall be based on actual field conditions.
- C. For all constant speed fans below 2 inches total static pressure, Contractor shall provide and install two sets of adjustable sheaves. First set shall be installed for initial start-up and shall be based on scheduled data. The second set shall be installed after the balance is complete and shall be based on actual field conditions, and selected at mid-range of the sheave.
- D. Set pitch diameters of fixed pitch and adjustable or variable pitch sheaves when adjusted as specified, at not less than that recommended by NEMA Standard MG1-14.42.
- E. For companion sheaves for adjustable or variable pitch drives, furnish wide groove spacing to match driving sheaves.
- F. For all variable frequency controller (VFC) operated fans, contractor shall provide and install one set of fixed sheaves sized to allow full utilization of fan motor horsepower provided, with VFC at 100 percent of fan motor RPM.

2.05 V-BELT FAN DRIVES

- A. Fan Drives: Multiple V-belt style with adjustable pitch driver sheaves for fans up to 2 inches of total static pressure and fixed pitch driver sheaves for fans at or above 2 inches of total static

pressure and up. Sheaves shall have split, taper style bushings. Drives shall be selected for a 150 percent service factor and shall provide for adjustment of both belt tension and alignment.

- B. Manufacturers:
 - 1. Emerson Power Transmission; Browning.
 - 2. Rockwell Automation; Dodge.
 - 3. T.B. Wood's Incorporated.

2.06 FAN DRIVE, SHAFT, AND COUPLING GUARDS

- A. Safety Provisions: Include guards and screens for power transmission equipment, but do not negate vibration isolation provision.
- B. Furnish ANSI and OSHA compliant mechanical power transmission apparatus guards except where superseded by other governing codes, and except as modified and supplemented. Requirements specified apply to all types of fans.
- C. Fabricate mechanical power transmission device guards such that the completed structure is capable of withstanding a load of at least 200 pounds applied in any direction.
- D. Furnish a guard enclosure for each V-belt drive, coupling, shaft, and rotating component. Secure guards in place, easily removable for maintenance. Guard fasteners used for maintenance access shall be "captive type." Locate holes on each guard for tachometer readings on both the motor and fan shafts. Fabricate guard of minimum 16 gage sheet metal with hemmed edges at openings for shafts. Weld four mounting lugs or feet of 10 gage material to the guard. Fabricate guards for couplings five inches in diameter and larger of 12 gage sheet metal. Furnish holes in mounting feet sized for suitable machine screws.
- E. Centrifugal exhaust fans shall be provided with shaft seals.

2.07 BELT DRIVE GUARDS

- A. Belt Guards: ANSI and OSHA compliant with provision for readily viewing belt tension and measuring shaft speeds. Guards shall be installed with quick release pins, so that removal of three to five clip pins, will allow the guard to be removed from fan housing.
- B. Fabricate guards which completely enclose moving parts of the particular drive. Design and construct guards of such rigidity as to contain a belt which breaks during operation. Minimum material thickness, 16 gage sheet metal. Where ventilation is required, perforated metal shall be used for the sides. Fabricate top of solid sheet metal.

2.08 V-BELTS

- A. Notched or cogged style, endless type, of Dacron reinforced elastomer construction, with cross-section to suit sheave grooves. Determine the number of V-belts from the motor horsepower to which apply the service factor to obtain the design horsepower. Determine the corrected horsepower per belt by multiplying the nominal horsepower per belt by an arc of contact factor not greater than 0.85. Divide the design horsepower by the corrected horsepower per belt to obtain the number of belts required. In any case, furnish not less than two belts for each drive.
- B. Furnish belts that have been factory or factory-authorized distributor matched and measured on a belt-matching machine. Selection by "code numbers," "sag numbers" or "match numbers" is not acceptable. Bind each belt set with wire and tag with equipment identification.
- C. Manufacturers:
 - 1. Emerson Power Transmission; Browning; AX, BX, and CX Series and 3VX and 5VX Series.
 - 2. Rockwell Automation; Dodge; Classic Cog and Narrow Cog V-Belts.
 - 3. T.B. Wood's Incorporated; Classical Cog and Narrow Cog V-Belts.

2.09 V-BELT DRIVE MOTOR BASES

- A. Furnish fan motors with slide or adjustable pivoted bases wherever equipment configuration permits proper installation.
- B. Provide for adjustment of both belt tension and alignment.

2.10 AIR HANDLING SYSTEM BALANCING PROVISIONS

- A. Provide extra sheaves, sized as recommended by the Balancing Agent, for the adjustment of fan speed for each air handling system during air quantity balancing operations. Furnish sheaves as specified in this Section.
- B. Provide sheaves, sized as recommended by the Balancing Agent, for the adjustment of fan speed for each existing air handling system requiring rebalancing during air quantity balancing operations. Furnish sheaves as specified in this Section.

2.11 FLEXIBLE COUPLINGS (DIRECT DRIVE)

- A. Fan shaft shall be connected to the motor shaft through a flexible coupling. The flexible member shall be a tire shape, in shear, or a solid mass serrated edge disc shape, made of chloroprene materials and retained by fixed flanges. Flexible coupling shall act as a dielectric connector and shall not transmit sound, vibration or end thrust.
- B. Manufacturer:
 - 1. Falk Corporation (The).

2.12 MOTOR REQUIREMENTS

- A. Furnish motors in accordance with Division 20 Section "Motors."

2.13 FAN BEARINGS

- A. Bearings: Anti-friction ball or roller type with provision for self-alignment and thrust load. Made in U.S.A. with ABMA L₁₀ minimum life of 200,000 hours. Use cast iron housings and dust-tight seals suitable for lubricant pressures.
 - 1. Lubrication Provisions - Use surface ball check type supply fittings. Provide extension tubes to allow safe maintenance while equipment is operating. Provide manual or automatic pressure relief fittings to prevent overheating or seal blow-out due to excess lubricant or pressure. Arrange relief fittings opposite supply but visible for normal maintenance observation.
 - 2. Bearings on Equipment with less than 1/2 horsepower rating or on shafts smaller than 1-3/4 inch in diameter: Permanently sealed, pre-lubricated anti-friction bearings per specified materials and ABMA L₁₀ life requirements.

2.14 IDENTIFICATION

- A. Nameplate: Affix metallic, corrosion-resistant data plate for each fan in a conspicuous location. Include selection point capacity conditions.

2.15 ACCESSORIES

- A. Bird Screens: Of material to match adjacent contact construction, 1/2 inch mesh or equal expanded metal. Use on inlet or outlet of each nonducted fan.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Field Rigging: Do not negate balancing. Do not bend shaft. Use lifting eyes.
- B. Install sheaves where recommended by Testing, Adjusting, and Balancing agency.
- C. Refer to individual Division 23 HVAC equipment Sections for additional requirements.

END OF SECTION 23 05 00

SECTION 23 05 23 GENERAL-DUTY VALVES FOR HVAC

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	1
1.04 SUBMITTALS	1
1.05 QUALITY ASSURANCE	1
1.06 DELIVERY, STORAGE, AND HANDLING	2
PART 2 PRODUCTS	2
2.01 VALVES, GENERAL	2
2.02 BRONZE BALL VALVES	2
2.03 DRAIN VALVES	3
PART 3 EXECUTION	3
3.01 EXAMINATION	3
3.02 VALVE INSTALLATION	3
3.03 JOINT CONSTRUCTION	3
3.04 ADJUSTING	4

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 21 fire-suppression piping and fire pump Sections for fire-protection valves.
 2. Division 20 Section "Mechanical Identification" for valve tags and charts.
 3. Division 22 Section "General-Duty Valves for Plumbing" for plumbing valves.
 4. Division 23 Section "Temperature Controls" for control valves and actuators.

1.02 SUMMARY

- A. This Section includes valves for general HVAC applications. Refer to piping Sections for specialty valve applications.

1.03 DEFINITIONS

- A. The following are standard abbreviations for valves:
 1. CWP: Cold working pressure.
 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
 3. NBR: Acrylonitrile-butadiene rubber.
 4. NRS: Nonrising stem.
 5. OS&Y: Outside screw and yoke.
 6. PTFE: Polytetrafluoroethylene plastic.
 7. RPTFE: Reinforced polytetrafluoroethylene plastic.
 8. SWP: Steam working pressure.
 9. TFE: Tetrafluoroethylene plastic.
 10. WOG: Water, oil, and gas.

1.04 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.05 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves.

- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

1.06 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.

PART 2 PRODUCTS

2.01 VALVES, GENERAL

- A. Isolation valves are scheduled on the Drawings. For other general HVAC valve applications, use the following:
1. Throttling Service: Ball valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- D. For valves not indicated in the Application Schedules, select valves with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for condenser water, heating hot water, steam, and steam condensate services.
 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged, solder-joint, or threaded ends.
 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.
- E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- G. Valve Actuators:
1. Lever Handle: For quarter-turn valves NPS 6 and smaller.
- H. EXTENDED VALVE STEMS: On insulated valves.
- I. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- J. Threaded: With threads according to ASME B1.20.1.
- K. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE BALL VALVES

- A. Bronze Ball Valves, General: MSS SP-110 and have bronze body complying with ASTM B 584, except for Class 250 which shall comply with ASTM B 61, full-depth ASME B1.20.1 threaded or solder ends, and blowout-proof stems.

- B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel ball and stem, reinforced TFE seats, blow-out-proof stem, with adjustable stem packing, soldered or threaded ends; 150 psig SWP and 600-psig CWP ratings.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; by Conbraco Industries, Inc.; Series 77C-140.
 - b. Crane Co.; Crane Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.; Models S-585-70-66 or T-585-70-66.
 - f. Watts Water Technologies, Inc.

2.03 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
 - 1. Bronze ball valve as specified in this Section.
 - 2. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. 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.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. 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.
- F. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 20 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe. Butterfly valves shall be installed with stem horizontal to allow support for the disc and the cleaning action of the disc.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Lift Check Valves: With stem upright and plumb.

3.03 JOINT CONSTRUCTION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.04 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 23 05 23

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	2
1.04 SUBMITTALS	2
1.05 QUALITY ASSURANCE	3
1.06 PROJECT CONDITIONS	3
1.07 COORDINATION	3
1.08 WARRANTY	4
PART 2 PRODUCTS (NOT APPLICABLE)	4
PART 3 EXECUTION	4
3.01 EXAMINATION	4
3.02 PREPARATION	5
3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING	5
3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS	5
3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS	6
3.06 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS	7
3.07 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS	7
3.08 PROCEDURES FOR HYDRONIC SYSTEMS	8
3.09 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS	8
3.10 PROCEDURES FOR MOTORS	8
3.11 PROCEDURES FOR CONDENSING UNITS	9
3.12 PROCEDURES FOR HEAT-TRANSFER COILS	9
3.13 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS	9
3.14 TOLERANCES	10
3.15 REPORTING	10
3.16 FINAL REPORT	10
3.17 INSPECTIONS	15
3.18 ADDITIONAL TESTS	16

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."
 - 2. Division 20 Section "Basic Mechanical Materials and Methods."
 - 3. Division 23 Section "Common Work Results for HVAC."

1.02 SUMMARY

- A. This Section includes testing, adjusting, and balancing to produce design objectives for the following:
 - 1. Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
 - 2. Hydronic Piping Systems:
 - a. Constant-flow systems.
 - b. Variable-flow systems.
 - c. Primary-secondary systems.
 - 3. Existing systems TAB.
 - 4. Verifying that automatic control devices are functioning properly.

5. Reporting results of activities and procedures specified in this Section.

- B. Include rebalancing of air systems, or system portions affected by recommended sheave changes.

1.03 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. AHJ: Authority having jurisdiction.
- C. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
- D. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- E. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- F. NC: Noise criteria.
- G. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- H. RC: Room criteria.
- I. Report Forms: Test data sheets for recording test data in logical order.
- J. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- K. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- L. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- M. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- N. TAB: Testing, adjusting, and balancing.
- O. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- P. Test: A procedure to determine quantitative performance of systems or equipment.
- Q. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.04 SUBMITTALS

- A. Qualification Data: Within 15 days from Contractor's Notice to Proceed, submit 2 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 15 days from Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit 2 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- E. Warranties specified in this Section.

1.05 QUALITY ASSURANCE

- A. Approved Balancing Agencies.
 - 1. The TAB firm selected shall be from the following list:
 - a. Absolut Balance Company, Inc.; South Lyon, MI.
 - b. Airflow Testing Inc.; Lincoln Park, MI.
 - c. Barmatic Inspecting Co., Inc.; Lincoln Park, MI.
 - d. Ener-Tech Testing; Holly, MI.
 - e. Enviro-Aire/Total Balance Co.; St. Clair Shores, MI.
 - f. International Test & Balance Inc.; Southfield, MI.
- B. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items: Include at least the following:
 - a. Submittal distribution requirements.
 - b. The Contract Documents examination report.
 - c. TAB plan.
 - d. Work schedule and Project-site access requirements.
 - e. Coordination and cooperation of trades and subcontractors.
 - f. Coordination of documentation and communication flow.
- C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems." TAB firm's forms approved by Architect.
- E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
 - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.06 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.07 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.08 WARRANTY

- A. National Project Performance Guarantee: If AABC standards are used, provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.
- B. Special Guarantee: If NEBB standards are used, provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- B. Examine system and equipment test reports.
- C. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- D. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- E. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
- F. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- G. Examine strainers for clean screens and proper perforations.
- H. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- I. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- J. Examine system pumps to ensure absence of entrained air in the suction piping.
- K. Examine equipment for installation and for properly operating safety interlocks and controls.
- L. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.

5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 6. Sensors are located to sense only the intended conditions.
 7. Sequence of operation for control modes is according to the Contract Documents.
 8. Controller set points are set at indicated values.
 9. Interlocked systems are operating.
 10. Changeover from heating to cooling mode occurs according to indicated values.
- M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Perform the following field tests and inspections to new and renovated portions of duct systems according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
 1. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
 2. Maximum Allowable Leakage: Leakage rates are scheduled on the Drawings.
- C. Complete system readiness checks and prepare system readiness reports. Verify the following:
 1. Permanent electrical power wiring is complete.
 2. Hydronic systems are filled, clean, and free of air.
 3. Automatic temperature-control systems are operational.
 4. Equipment and duct access doors are securely closed.
 5. Balance, smoke, and fire dampers are open.
 6. Isolating and balancing valves are open and control valves are operational.
 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- B. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- C. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts, or use reduced scale contract documents with notations.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Cut insulation, and drill ducts for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes with neat patches, neoprene plugs, threaded plugs, or threaded twist-on metal caps, and patch

insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

- F. Check air flow within intake plenums and mixing boxes of air handling units for uneven flow and temperature stratification and prepare a report with profile elevations (temperature and velocity) on each coil or filter face for Architect.
- G. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- H. Verify that motor starters are equipped with properly sized thermal protection.
- I. Check dampers for proper position to achieve desired airflow path.
- J. Check for airflow blockages.
- K. Check condensate drains for proper connections and functioning.
- L. Check for proper sealing of air-handling unit components.
- M. Check for proper sealing of air duct system.

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
 - 4. Select required sheave sizes and advise installing contractor to change drive sheaves accordingly. Refer to Division 23 Section "Common Work Results for HVAC" for additional requirements.
 - 5. When existing air handling systems require rebalancing, select required sheave sizes and advise Mechanical Contractor to change drive sheaves accordingly. Refer to Division 23 Section "Common Work Results for HVAC" for additional requirements.
 - 6. Do not recommend fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure airflow at a point downstream from the balancing damper and adjust volume dampers until the proper airflow is achieved.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 - 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.06 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 3. Measure total system airflow. Adjust to within indicated airflow.
 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
 6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
 7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
 8. Record the final fan performance data.

3.07 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts, or use reduced scale contract documents with notations.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 1. Open all manual valves for maximum flow.
 2. Check expansion tank liquid level.
 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
 4. Check flow-control valves for specified sequence of operation and set at indicated flow.
 5. Set system controls so automatic valves are wide open to heat exchangers.

6. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

3.08 PROCEDURES FOR HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:
 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 4. Report flow rates that are not within plus or minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 1. Determine the balancing station with the highest percentage over indicated flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 3. Record settings and mark balancing devices.
- F. Equipment installed with pressure independent characterized control valves (PICCV) or auto-flow devices shall not require hydronic system balancing unless multiple coils are served from a single PICCV or auto-flow device (Example: AHU coil banks with multiple coils). Measure flow through each PICCV and auto-flow device and compare measured value to scheduled value to verify proper valve/device was installed and valve is functional. Verify flow for 100 percent of PICCV and auto-flow devices. Report discrepancies.
- G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- H. Measure the differential-pressure control valve settings existing at the conclusions of balancing, and record in report.

3.09 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance variable-flow hydronic systems by following the "Proportional Balancing Procedure" in accordance with NEBB.
- B. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Power factor.
 6. Nameplate and measured voltage, each phase.
 7. Nameplate and measured amperage, each phase.
 8. Starter size.
 9. Starter thermal-protection-element rating.
 10. Fuse number and size.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.11 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.12 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Water Coils: Measure the following data for each coil:
 1. Entering- and leaving-water temperature.
 2. Water flow rate.
 3. Water pressure drop.
 4. Dry-bulb temperature of entering and leaving air.
 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 6. Airflow.
 7. Air pressure drop.
- B. Electric-Heating Coils: Measure the following data for each coil:
 1. Nameplate data.
 2. Airflow.
 3. Entering- and leaving-air temperature at full load.
 4. Voltage and amperage input of each phase at full load and at each incremental stage.
 5. Calculated kilowatt at full load.
 6. Fuse or circuit-breaker rating for overload protection.
- C. Steam Coils: Measure the following data for each coil:
 1. Dry-bulb temperature of entering and leaving air.
 2. Airflow.
 3. Air pressure drop.
 4. Inlet steam pressure.
- D. Refrigerant Coils: Measure the following data for each coil:
 1. Dry-bulb temperature of entering and leaving air.
 2. Wet-bulb temperature of entering and leaving air.
 3. Airflow.
 4. Air pressure drop.
 5. Refrigerant suction pressure and temperature.

3.13 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 3. Check the condition of filters.

4. Check the condition of coils.
 5. Check the operation of the drain pan and condensate drain trap.
 6. Check bearings and other lubricated parts for proper lubrication.
 7. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.
1. New filters are installed.
 2. Coils are clean and fins combed.
 3. Drain pans are clean.
 4. Fans are clean.
 5. Bearings and other parts are properly lubricated.
 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
 2. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
 3. Air balance each air outlet.

3.14 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
1. Air handling equipment and outlets: Plus or minus 5 percent.
 - a. Where terminal units serve 6 or more outlets within a common room, individual outlets may vary up to plus or minus 10 percent of design flow rates if overall room supply is within plus or minus 5 percent.
 2. Heating-Water Flow Rate: 0 to minus 10 percent.
 3. Cooling-Water Flow Rate: 0 to plus 5 percent.

3.15 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.16 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.

5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
 1. Title page.
 2. Name and address of TAB firm.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB firm who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Notes to explain why certain final data in the body of reports varies from indicated values.
 14. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 1. Quantities of outside, supply, return, and exhaust airflows.
 2. Water flow rates.
 3. Terminal units.
 4. Balancing stations.
- F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
 1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - j. Number of belts, make, and size.
 - k. Number of filters, type, and size.
 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.

- d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - g. Power factor efficiency.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat coil static-pressure differential in inches wg.
 - g. Cooling coil static-pressure differential in inches wg.
 - h. Heating coil static-pressure differential in inches wg.
 - i. Outside airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outside-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.
- G. Apparatus-Coil Test Reports:
 - 1. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft..
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
 - 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outside-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Water flow rate in gpm.
 - i. Water pressure differential in feet of head or psig.
 - j. Entering-water temperature in deg F.
 - k. Leaving-water temperature in deg F.
- H. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
 - 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btuh.
 - h. Ignition type.
 - i. Burner-control types.

- j. Motor horsepower and rpm.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches, and bore.
 - n. Sheave dimensions, center-to-center, and amount of adjustments in inches.
- 2. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Entering-air temperature in deg F.
 - c. Leaving-air temperature in deg F.
 - d. Air temperature differential in deg F.
 - e. Entering-air static pressure in inches wg.
 - f. Leaving-air static pressure in inches wg.
 - g. Air static-pressure differential in inches wg.
 - h. Low-fire fuel input in Btuh.
 - i. High-fire fuel input in Btuh.
 - j. Manifold pressure in psig.
 - k. High-temperature-limit setting in deg F.
 - l. Operating set point in Btuh.
 - m. Motor voltage at each connection.
 - n. Motor amperage for each phase.
 - o. Heating value of fuel in Btuh.
- I. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 - 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - g. Number of belts, make, and size.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..

- g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- K. Air-Terminal-Device Reports:
 - 1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Test apparatus used.
 - d. Area served.
 - e. Air-terminal-device make.
 - f. Air-terminal-device number from system diagram.
 - g. Air-terminal-device type and model number.
 - h. Air-terminal-device size.
 - i. Air-terminal-device effective area in sq. ft..
 - 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary airflow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final airflow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
 - 1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
 - 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Entering-water temperature in deg F.
 - c. Leaving-water temperature in deg F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
- M. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:
 - 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Unit make and model number.
 - d. Compressor make.
 - e. Compressor model and serial numbers.
 - 2. Test Data (Indicated and Actual Values):
 - a. Inlet-duct static pressure in inches wg.
 - b. Outlet-duct static pressure in inches wg.
 - c. Entering-air, dry-bulb temperature in deg F.
 - d. Leaving-air, dry-bulb temperature in deg F.
 - e. Condenser entering-water temperature in deg F.
 - f. Condenser leaving-water temperature in deg F.
 - g. Condenser-water temperature differential in deg F.

- h. Condenser entering-water pressure in feet of head or psig.
 - i. Condenser leaving-water pressure in feet of head or psig.
 - j. Condenser-water pressure differential in feet of head or psig.
 - k. Control settings.
 - l. Voltage at each connection.
 - m. Amperage for each phase.
 - n. Kilowatt input.
 - o. Crankcase heater kilowatt.
 - p. Number of fans.
 - q. Condenser fan rpm.
 - r. Condenser fan airflow rate in cfm.
 - s. Condenser fan motor make, frame size, rpm, and horsepower.
 - t. Condenser fan motor voltage at each connection.
 - u. Condenser fan motor amperage for each phase.
- N. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
- 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model and serial numbers.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.
 - i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
 - 2. Test Data (Indicated and Actual Values):
 - a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.
- O. Instrument Calibration Reports:
- 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.17 INSPECTIONS

- A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Measure sound levels at two locations.
 - e. Measure space pressure of at least 10 percent of locations.
 - f. Verify that balancing devices are marked with final balance position.
 - g. Note deviations to the Contract Documents in the Final Report.
- B. Final Inspection:
 1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
 2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
 3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
 4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
 6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
 7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.18 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 09 33
TEMPERATURE CONTROLS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS.....	1
1.02 SUMMARY	2
1.03 DEFINITIONS	2
1.04 SYSTEM DESCRIPTION	2
1.05 SEQUENCE OF OPERATION	2
1.06 SUBMITTALS	2
1.07 REFERENCES	4
1.08 QUALITY ASSURANCE.....	5
1.09 DELIVERY, STORAGE, AND HANDLING	5
1.10 COORDINATION.....	5
1.11 WARRANTY	5
1.12 POSTED OPERATING INSTRUCTIONS	6
1.13 SPECIAL TOOLS	6
1.14 PROTECTION OF PROPRIETARY INFORMATION.....	6
PART 2 PRODUCTS	6
2.01 DESCRIPTION OF THE BUILDING AUTOMATION SYSTEM (BAS).....	6
2.02 DDC CONTROLLERS.....	6
2.03 DDC CONTROLLER SOFTWARE.....	7
2.04 DDC AIR TERMINAL UNIT CONTROLLERS	8
2.05 DDC INPUT/OUTPUT SENSORS	9
2.06 AIRFLOW MEASURING PROBES – DUCT MOUNTED	11
2.07 AIRFLOW MEASURING PROBES – OUTSIDE AIRFLOW.....	12
2.08 INSTRUMENTATION TUBING	12
2.09 CONTROL VALVES AND VALVE OPERATORS.....	12
2.10 SOLENOID VALVES - GAS	13
2.11 DAMPERS - AUTOMATED.....	13
2.12 DAMPER OPERATORS - ELECTRIC	14
2.13 LOCAL AND AUXILIARY CONTROL PANELS	14
2.14 THERMOSTATS – ELECTRONIC & ELECTRIC.....	14
2.15 STATUS SENSORS AND DEVICES - ELECTRIC	15
2.16 ELECTRICAL REQUIREMENTS FOR CONTROLS WORK	15
PART 3 EXECUTION.....	16
3.01 INSTALLATION - CONTROL SYSTEMS.....	16
3.02 TC CONTRACTOR DESIGN & INSTALLATION COORDINATION MEETINGS	17
3.03 IDENTIFICATION AND MARKING	17
3.04 GRAPHIC DISPLAY GENERATION	17
3.05 OWNER INSTRUCTION AND TRAINING	18
3.06 CALIBRATION AND START-UP	18
3.07 ACCEPTANCE PROCEDURE	18

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.
- B. Related Sections include the following:
 1. Division 20 Section "Mechanical General Requirements."
 2. Division 20 Section "Basic Mechanical Materials and Methods."
 3. Division 23 Section "Testing, Adjusting, and Balancing."

4. Division 26 Section "Electrical General Requirements" and any related Section for power, control, and communication wiring.

1.02 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

1.03 DEFINITIONS

- A. BAS: Building Automation System
- B. CAD: Computer Aided Design.
- C. DDC: Direct-digital controls.
- D. EWIC: Electrical Wiring/Installation Contractor for Controls
- E. TC: Temperature Control.

1.04 SYSTEM DESCRIPTION

- A. Temperature control building automation system consisting of direct digital control (DDC) system panels, sensors, transducers, relays, switches, data communication network, etc. and all associated control wiring and raceway systems. The new temperature controls shall interface with the existing Siemens building automation system
- B. BAS/DDC system programming, database and graphic display generation at the existing operator workstation.
- C. Electric control valves, dampers, operators, control wiring, etc.
- D. Electric and electronic control accessories and other control system instrumentation and devices.
- E. All electrical power wiring, conduit, data communication wiring, etc. and all associated control wiring and raceway systems as it relates to the new temperature controls shall interface with the existing Siemens building automation and be wired by the EWIC.

1.05 SEQUENCE OF OPERATION

- A. Control sequences for HVAC systems, subsystems, and equipment are indicated on project drawings.

1.06 SUBMITTALS

- A. Submit under Division 20, 22, and 23 provisions of respective project and as supplemented in this section.
- B. All control submittal requirements shall be submitted at one time with exception to control valves, automated dampers, and initial phases of work associated with fast-track projects (when required). Early submittals of control valve and automated dampers shall be incorporated with the complete temperature controls submittal.
- C. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 1. Each control device labeled with setting or adjustable range of control
- D. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- E. Shop Drawings:
 1. Shop drawings shall be done on CAD. Minimum size 11" x 17".
 2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 3. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

4. Details of control panel faces and interior, including controls, instruments, terminal blocks and labeling.
 5. Written sequence of operation for each controlled system.
 6. Schedule of dampers including size, leakage, and flow characteristics (Refer to Design Data).
 7. Schedule of valves including leakage and flow characteristics (Refer to Design Data).
 8. Complete bill of materials to identify and quantify all control components
 9. Overall system schematic showing communication trunk cabling to DDC panels, peripheral devices, modems including component locations and wire termination details.
 10. DDC panel layouts showing connected data points and LAN connections. DDC panel terminations including power supply and remote control component termination details shall be provided.
 11. Point list for each DDC panel including point descriptions and addresses. This information may be incorporated with DDC panel layouts.
- F. Design Data: Provide indicated component selection and sizing criteria for the following component categories:
1. Control valves:
 - a. Component tag.
 - b. Equipment served/function.
 - c. Media type.
 - d. Design flow rate (GPM).
 - e. Design pressure drop in psig.
 - f. Calculated valve Cv.
 - g. Selected valve Cv.
 - h. Resultant pressure drop in psig of selected valve.
 - i. Selected valve GPM (Pressure Independent Control Valves only)
 - j. Valve size.
 - k. Line size to valve connection (excluding reducers).
 - l. Type (ball, butterfly, globe, etc.).
 - m. Configuration (2-way, 3-way mixing, 3-way diverting).
 - n. Normal position (normally open, normally closed, floating).
 - o. Actuator spring range (where applicable).
 - p. Actuator power requirement.
 - q. Valve shut-off rating (ft. head) of (psig)
 - r. Valve body pressure/temperature rating.
 - s. Valve manufacturer/model number.
 - t. Actuator manufacturer/model number.
 2. Dampers:
 - a. Component tag.
 - b. Equipment served/function.
 - c. Overall damper size (inch height x inch width).
 - d. Quantity of damper sections with respective size(s):
 - e. Material and gauge of thickness.
 - f. Mounting orientation (horizontal or vertical).
 - g. Blade configuration (parallel or opposed)
 - h. Pressure drop (in. W.G.).
 - i. Shut-off rating/differential pressure rating (in. W.G.).
 - j. Leakage rating (CFM/sq. ft. at 4 in. W.G.).
 - k. Normal position (normally open, normally closed, floating).
 - l. Actuator spring range (where applicable).
 - m. Actuator power requirement.
 - n. Actuator torque requirement.
 - o. Actuator quantity.
 - p. Damper manufacturer/model number.
 - q. Actuator manufacturer/model number.

3. Flow measuring probes - Air:
 - a. Component tag.
 - b. Equipment served/function.
 - c. Duct dimension (inch height x inch width) if applicable.
 - d. Fan inlet diameter (inch) if applicable)
 - e. Probe quantity.
 - f. Probe length.
 - g. Flow rate (CFM).
 - h. Flow velocity (FPM).
 - i. Probe manufacturer/model number.
 - j. Transmitter manufacturer/model number.
4. Flow measuring stations - Air:
 - a. Component tag.
 - b. Equipment served/function.
 - c. Duct dimension (inch height x inch width).
 - d. Station dimension (inch height x inch width).
 - e. Flow rate (CFM).
 - f. Flow velocity (FPM).
 - g. Pressure drop (in. W.G.).
 - h. Station manufacturer/model number.
 - i. Transmitter manufacturer/model number.
5. Gauges:
 - a. Component tag.
 - b. Equipment served/function.
 - c. Units/range of scale
- G. Samples: Temperature sensor cover for each color required and guards if required.
- H. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- I. Submit field reports indicating operating conditions after detailed check out of systems at Date of Substantial Completion.
- J. Project Record Documents: Include the following:
 1. Revise Shop Drawings to reflect actual installation and operating sequences.
 2. Record actual locations of control components, including control units and sensors.
 3. Submit the electronic files for all as-built shop drawings on diskette in pdf format.
- K. Software and Firmware Operational Documentation: Include the following:
 1. DDC panel keypad operating instructions and DDC panel control override features where applicable.
 2. Device address list.
 3. Program Software Backup: On a magnetic media or compact disc, complete with data files.
- L. Maintenance Manuals: Include the following:
 1. Product data with installation details, maintenance instructions and lists of spare parts for each type of control device.
 2. Keypad illustrations and step-by-step procedures indexed for each operator function where applicable.
 3. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
 4. Calibration records and list of set points.

1.07 REFERENCES

- A. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
- B. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure fittings.
- C. ANSI/ASTM B32 - Solder Metal.

- D. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- E. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- F. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- G. ASTM B75 - Seamless Copper Tube for General Engineering Purposes.
- H. ASTM D1693 - Environmental Stress - Cracking of Ethylene Plastics.
- I. NEMA DC 3 - Low-Voltage Room Thermostats.
- J. ASTM E1 - Specification for ASTM Thermometers.
- K. UL 1820 - Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics Only.
- L. ASHRAE 135 - BACNET

1.08 QUALITY ASSURANCE

- A. Electrical Installer Qualifications: Must be an experienced installer who has previously installed the Siemens automatic control system for this Project. Installer shall attend Pre-Bid Walk-through and Post-Bid Interview (when required).
- B. Manufacturer Qualifications: A firm experienced in manufacturing automatic temperature-control systems similar to those indicated for this Project and with a record of successful in-service performance.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated or optional to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

1.10 COORDINATION

- A. Coordinate work under Division 20, 22, and 23 provisions and as supplemented in this section.
- B. Coordinate location of space temperature sensors and other exposed control sensors with plans and room details before installation.
- C. Coordinate installation of system components with installation of mechanical systems and equipment to achieve compatibility.
- D. Ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate control wiring requirements, including actual terminal block numbers, with mechanical equipment manufacturers or suppliers.
- F. Coordinate equipment with Division 28 Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.
- G. Ensure control system installation is complete, checked, tested and functioning properly prior to system balancing and Owner/Engineer system checkout.
- H. Cooperate fully with the Test and Balance Contractor and provide labor to operate the temperature control system as required to meet the scope of work defined in Division 23 Section "Testing, Adjusting, and Balancing."

1.11 WARRANTY

- A. Provide warranty per Division 20 Section "General Mechanical Requirements" and as supplemented in this section.

- B. Provide 24 hour per day emergency service during warranty period, with maximum response period of four (4) hours. Provide phone number(s) for quick assistance by a Service Engineer regarding hardware or software problems.
- C. Provide scheduled maintenance service during warranty period to inspect, calibrate, and adjust controls. Make a minimum of one eight hour service call every three months. Notify Owner prior to each scheduled inspection trip. Submit written reports upon completion of service.
- D. Provide any software or firmware revisions for controllers provided with project which are released by the DDC system manufacturer during the warranty period, at no additional cost to the Owner.

1.12 POSTED OPERATING INSTRUCTIONS

- A. Provide panel related as-built documents in protective binder or clear plastic display envelope for each control panel. These instructions shall include such items as as-built control diagrams and sequence of operation, simplified narrative instructions and materials necessary to aid in the operation of the equipment at the local control panels.

1.13 SPECIAL TOOLS

- A. Deliver two sets of any special tools required for operation, adjustment, resetting or maintenance, not including PC Laptop.

1.14 PROTECTION OF PROPRIETARY INFORMATION

- A. All proprietary manuals and software non-disclosure agreements, where applicable, shall be submitted by the proprietary equipment manufacturer to the Owner for approval and signature during the warranty period.

PART 2 PRODUCTS

2.01 DESCRIPTION OF THE BUILDING AUTOMATION SYSTEM (BAS)

- A. This project's controls and controllers shall integrate to the WSU campus-wide building automation system (BAS) and be a fully integrated, distributed data processing system incorporating DDC for the control and monitoring of heating, ventilating and air conditioning (HVAC) equipment and other related systems. Microprocessor based DDC panels shall be directly connected to HVAC equipment sensors and actuators. A data communication network shall allow data exchange between existing and new DDC panels and each building's existing Network Controller (Siemens). Each building's existing Network Controller is connected to the owner's Ethernet and communicates with the owner's existing central BAS.
- B. WSU IT staff shall provide IP drops for equipment controllers in locations and quantities coordinated with Siemens.
- C. Approved Manufacturer – System / Installer (Location):
 - 1. Siemens Industry, Inc. – Apogee System 600 / Siemens - Building Technologies Division (Plymouth, MI).

2.02 DDC CONTROLLERS

- A. Manufacturer:
 - 1. DDC Controller Models: Siemens PXCC
 - 2. DDC Controller/Network Controller: PXCM
- B. Modular in design and consisting of stand-alone microprocessor board with ROM and fully custom programmable RAM, EPROM, and/or EEPROM memory, integral interface equipment and power surge protection. DDC panels shall be connected directly to sensors, controlled devices and the communication network.
- C. Powerfail Restart and Battery Backup: Minimum of 72 battery backup hours for complete system RAM memory and clock, with automatic battery charger or 48 hour low voltage alarm warning. Upon full system power recovery, all clocks shall be automatically synchronized, and all controlled equipment shall be automatically re-started based on correct clock time and sequence of operation.

- D. Provide fully functional communication interface ports for communication between processor, other processors, existing Building Network Controller, portable operator unit and portable programmer terminal.
- E. Panel enclosure shall be finished steel or rigid plastic with hinged door and keyed lock. Electronics shall be removable for protection during mounting of panel.

2.03 DDC CONTROLLER SOFTWARE

- A. Operating system shall work in real time, provide prioritized task scheduling, control time programs, monitor DDC panel to DDC panel as well as DDC panel to existing Building Network Controller communications, scan inputs and outputs, and contain built-in diagnostics.
- B. Input/output point processing shall include the following:
 - 1. Continuous update of input and output values and/or conditions. All connected points are to be updated at least once per second.
 - 2. Assignment of proper engineering units and status condition identifiers to all points.
 - 3. In addition to physical or "hardware" points required, "software" points shall be provided where required for command access and meaningful displays, where required by the "execution" portion of this section or where required on the DDC input/output points lists. "Software" points shall appear identical to physical points in output displays and shall be assignable to text descriptors, logical groups, reports, etc. in the same manner as physical points. "Software" points shall be assigned alarm limits in the same manner as physical points.
- C. Command control software shall manage the receipt of commands from the existing Building Network Controller and from control programs.
 - 1. Command delay, programmable from 0 to 2 minutes, shall be provided to prevent simultaneous energizing of large loads. Command delays shall be honored throughout the DDC network, not just within the DDC panel. Delays shall be assignable on an individual per point basis.
 - 2. Each command shall be assigned a command and residual priority to manage contentions created by multiple programs having access to the same command point. Only commands with a higher command priority than the existing residual priority shall be permitted to execute. Whenever a command is allowed to execute, its assigned residual priority shall replace the existing residual priority.
 - 3. A "fixed mode" option shall be supported to allow inputs to, and outputs from DDC control programs to be set to a fixed state or value. When in the "fixed mode," inputs and outputs shall be so noted in all reports.
 - 4. A "last user" record is to be maintained to positively identify which program or manual command is in control of a given point. The last user information shall be displayed and printed along with other point data of logical groups.
- D. Provide self-test procedure. Notify existing Building Network Controller for maintenance, performance, software, cable break, or data transmission problems. Identify variables as reliable or unreliable. Variables identified as unreliable shall use default in calculation.
- E. Alarm Processing
 - 1. High/Low Alarm: Analog input alarm comparison with the ability to assign two individual sets of high and low limits (warning and actual alarm) to an input. Each alarm shall be assigned a unique differential to prevent a point from oscillating into and out of alarm. Alarm comparisons are to be made each scan cycle.
 - 2. Floating Alarm: Where analog controlled values are automatically varied by software (such as hot water temperature reset), a single set of alarm limits shall be provided for those varying values. These alarm limits shall then "float" a user definable differential above and below the varying setpoint value.
 - 3. Abnormal Alarm: When a digital input is not in agreement with the commanded state of its associated output point, or when a digital input is not in its normal state, an abnormal alarm shall be generated. Abnormal "on" shall cause an alarm, as well as abnormal "off." Alarm time delay for digital inputs to prevent nuisance alarms shall be provided. Each digital input alarm time delay shall be adjustable from zero to two minutes in one-second increments.

4. Alarm lockout shall be provided to positively lock out alarms when equipment is turned off or when a true alarm is dependent on the condition of an associated point. Lockout points and lockout initiators shall be operator programmable. On initial startup of air handler and other mechanical equipment, a "timed lockout" period shall be assigned to analog points to allow them to reach a stable condition before activating alarm comparison logic. Timed lockout period shall be programmable on a per point basis from 0 to 90 minutes in one-minute increments.
 5. The capability of automatically initiating commands upon the occurrence of an alarm.
- F. Totalization
1. Run time shall be accumulated based on the status of digital input points. It shall be possible to totalize either on time or off time up to 10,000 hours with one-minute resolution. Run time counts shall be resident in memory and have DDC panel resident run time limits assignable through the portable programmer's terminal, portable operators unit or the existing Building Network Controller.
 2. A transition counter shall be provided to accumulate the number of times a device has been cycled on or off. Counter shall be capable of accumulating 600,000 switching cycles. Limits shall be assignable to counts to provide maintenance alarm printouts.
 3. Analog totalization capability shall be provided to allow the totalization of electricity, air, water and steam flow, etc. These flows shall be totalized with respect to time and converted to the appropriate energy unit. It shall be possible to automatically set time intervals for totalization, adjustable from one second to 365 days. The totalization program shall keep track of the maximum and minimum instantaneous analog value measured during the period, including the date and time at which each occurred.
- G. Custom DDC Programs
1. All DDC programs shall be fully custom programmable. DDC panels or systems which require remote or factory programming are not acceptable. DDC panels or systems with programs which may not be custom modified by the user are not acceptable. "Custom" programming shall mean allowing the alteration of actual control logic, and shall not be limited to allowing only the alteration of setpoints, gains, parameters, time constants, etc.
 2. Custom DDC programs shall be provided to meet the control strategies as called for in the sequences of operation on the drawings.
 3. All DDC setpoints, gains, parameters, time constants, etc., associated with DDC programs shall be available to the operator for display and modification via the existing Building Network Controller and/or portable operators unit.
 4. The execution interval of each DDC control loop shall be adjustable from two to 30 seconds.
 5. Each DDC panel shall have resident in its memory and available to the programs a full library of DDC algorithms, intrinsic control operators, and arithmetic, logic and relational operators for implementation of control sequences. Functions to be provided shall include, but not be limited to, the following:
 - a. Mathematical: Absolute value, calculate, square root, power, sign, average, totalize.
 - b. Logic: OR, AND, compare, negate.
 - c. Fixed Formula: High and low select, span, rate, ramp, enthalpy, wet bulb, dew point, relative humidity, humidity ratio, and filter.
 - d. Data Manipulation: Store, file and set.
 - e. Control Routines: Real-time based functions, proportional control, proportional-integral control, proportional-integral-derivative control, adaptive control (self tuning), direct-acting, reverse acting, feedforward, fixed setpoint, calculated setpoint, adjustable setpoint, lead lag, hysteresis correction, event initiation/ software interlock.

2.04 DDC AIR TERMINAL UNIT CONTROLLERS

- A. Manufacturer:
1. DDC Terminal Equipment Controller Model: Apogee TEC

- B. Microprocessor based controllers capable of stand-alone operation for control of pressure independent air terminal units. Controllers shall be networked together and connected to the building's BAS/DDC network.
- C. Controllers shall have separate adjustable minimum and maximum airflow setpoints. Controllers shall work in conjunction with the air handling unit's DDC panel to provide the sequence of operation as indicated on the drawings. Setpoints shall be adjustable through the portable programmer terminal.
- D. Provide electronic type air terminal unit damper operators compatible with the controller and the air terminal units provided.
- E. Each controller shall have an internal differential pressure transducer capable of utilizing the total and static pressure signals from the air terminal unit's velocity sensor. Velocity sensor shall be furnished by air terminal unit manufacturer.
- F. Each controller shall have electronic outputs compatible with the electronically operated air terminal unit tempering coil control valve and perimeter radiation control valve where applicable
- G. TC contractor shall provide 24 VAC power requirements including transformers.
- H. If coordinated with mechanical contractor. Controllers and damper operators shall be furnished to the air terminal unit manufacturer for factory mounting by the air terminal unit manufacturer; otherwise, controls shall be field installed.
- I. Room temperature sensors for the DDC air terminal unit controllers:
 - 1. Sensing Element: Thermistor type or resistance temperature detector (RTD). Accuracy shall be +/- 0.5 degrees F over the range of 55 degrees F to 95 degrees F.
 - 2. Cover: Locking type.
 - 3. Provide with exposed setpoint adjustment dial and exposed temperature reading.
 - 4. Provide with exposed override switch to allow an occupant to reset the space to occupied control during the unoccupied cycle for a predetermined time period.
 - 5. Provide with portable operator unit plug-in port.

2.05 DDC INPUT/OUTPUT SENSORS

- A. Current Switches:
 - 1. Split-core donut transformer type for monitoring AC current, with digital output signal. Current switches used on motor side of variable frequency drives shall have low frequency detection capability.
 - 2. Current switches with digital output shall have adjustable trip settings. Field-adjust current switches to trip at approximately 90% of normal motor operating amperage.
 - 3. Manufacturers:
 - a. NK Technologies.
 - b. Senva.
 - c. Setra.
 - d. Veris Industries.
- B. Temperature Sensors:
 - 1. Resistance temperature detectors (RTD) with platinum, nickel or balco element. Accuracy shall be +/- 0.5 deg F over the entire range. Range shall be as indicated below, or as appropriate to the application.
 - 2. Single point duct mounted sensors shall have 18" minimum, rigid probe and up to 48", rigid, averaging with a calibrated span of 20 - 120° F.
 - 3. Averaging duct mounted sensors shall have 25' long averaging element and calibrated span of 20 - 120° F.
 - 4. Liquid immersion sensors shall have welded stainless steel thermowell for ferrous pipe and brass thermowell for copper pipe. Length of sensor and thermowell shall be selected based on the diameter of the pipe to provide accurate, reliable and homogeneous sensing of the liquid temperature. Thermowell pressure rating shall meet or exceed the system minimum pressure rating. Sensors for chilled water application shall have calibrated span of 20 - 120° F.
 - 5. Room sensors shall have locking cover and a minimum span of 40 - 90° F.

6. Outside air sensors shall have watertight inlet fitting and shall be shielded from direct rays of sun.
7. Manufacturers:
 - a. Specified BAS product where available.
 - b. TCS.
 - c. Minco.
 - d. ACI.
 - e. MAMAC.
- C. Outside Air Temperature/Humidity Combination Transmitters:
 1. Dual transmitters housed in a single hinged enclosure with integral probes configured for exterior wall mount application with PVC sun shield. Unit shall provide separate 4-20 mA signals for temperature and humidity measurement.
 2. Temperature sensor shall be 1000 OHM thin film platinum resistance temperature detector with matching 4-20 mA transmitter having independent zero and span adjustments. Accuracy shall be ± 0.5 degrees F with a range of -25 degrees F to 125 degrees F.
 3. Humidity sensor shall be washable thin film type with matching 4-20 mA transmitter having independent zero and span adjustments and linear output over a span of 0-100% RH. Accuracy shall be $\pm 2.5\%$ RH over the range 0-95% RH at 25 degrees C.
 4. Manufacturer:
 - a. GE Industrial, Sensing (formerly General Eastern)
 - b. Veris.
- D. Differential Pressure Transmitters:
 1. Transmitters used for measuring differential pressure only:
 - a. Each differential pressure transmitter shall be selected and calibrated for operations between 0 and 200% of the normal differential pressure. The calibration point shall be rounded upward to the nearest 10 inches of water column (for spans less than 200" W.C.) or to the nearest 5 psi for larger spans. Calibration date shall be included on an embossed tag attached to each transmitter.
 - b. The accuracy, including linearity, hysteresis and repeatability, of the transmitter for measuring differential pressure shall be better than 2% of the span stated above throughout a 4:1 turndown.
 - c. The transmitter shall not be damaged by pressures of up to 500 psig on either side of the transmitter and all wetted parts shall be essentially inert in the presence of up to a 40% concentration of ethylene glycol in water.
 - d. Provide a drain valve for each side of the pressure chamber. Furnish and install mounting brackets appropriate for the installation location.
 - e. Span and zero shall be individually adjustable.
 - f. With LCD Display.
 - g. Manufacturers:
 - 1) Dwyer.
 - 2) Setra.
 - 3) Veris Industries.
 2. Three Valve Manifold:
 - a. Provide a three-valve manifold for each transmitter. The manifold shall not be damaged by pressures of up to 500 psig and all wetted parts shall be essentially inert in the presence of up to a 40% concentration of ethylene glycol in water.
 - b. The manifold shall be designed for direct mounting on the transmitter it serves and utilize two quarter turn valves to provide zeroing, blocking and normal service modes.
- E. Air Static/Differential Pressure Transmitters:
 1. Variable capacitance type with ranges not exceeding 150 percent of maximum expected input. Transmitter shall have zero and span adjustments.
 2. Safe overpressure rating shall be minimum 5 times the range.

3. Temperature compensated with thermal error of not greater than 0.04 percent of full scale in temperature range of 40 to 100 deg F.
 4. Accuracy: One percent of full scale.
 5. Manufacturers:
 - a. Dwyer.
 - b. Setra.
 - c. Modus.
 - d. Air Monitor.
- F. Differential Pressure Switches:
1. Shall provide electrical switching action upon a sensed pressure differential increase between two points. Sensitivity shall be suitable for the application. Setpoint shall be adjustable over the full range of the device. Switching action shall open or close two independent single pole double throw switches. Electrical switch rating shall be 10 amps at 120 VAC.
 2. Pressure rating of switch and connecting tubing:
 - a. Fan - Rated for 12 inches W.C.
- G. Reference Probe - Duct Static Pressure:
1. Duct static pressure probe shall be capable of static pressure measurement with bi-directional flow in a duct, plenum or air handling unit. Probe shall have minimum 4" insertion depth, shall compensate for total pressure error, and shall provide an accurate, repeatable and stable static pressure value with a maximum flow of 4000 fpm.
 2. Probe shall be constructed of aluminum, with mounting flange suitable for round or flat duct surfaces. Probe shall have static pressure signal fitting.
 3. Manufacturers:
 - a. MAMAC # A-520.
 - b. Dwyer # A-305.
 - c. Tek-Air # T-SPP 7100/7200.

2.06 AIRFLOW MEASURING PROBES – DUCT MOUNTED

- A. Duct airflow measuring probes shall contain multiple total and static pressure sensors located along the exterior surface of the probe, designed to compensate for non-axial or turbulent flow.
- B. Thermal Dispersion type technology may be used in-lieu of static pressure measurement.
- C. Probes shall be constructed of extruded aluminum. Probes shall be provided with mounting plate, gasket, and static and total pressure fittings. Probe and mounting hardware shall facilitate easy removal and reinstallation of the probes.
- D. The number of sensors on each probe, and the quantity of probes provided at each location, shall comply with ASHRAE standards for duct traversing. Multiple probes provided at a single location shall be interconnected external to the duct to produce an average signal.
- E. For each airflow measurement location, the measured velocity pressure shall have accuracy within $\pm 2\%$ of the full scale throughout the velocity range of 300-4000 fpm.
- F. Each airflow measurement location shall be provided with an air volume gauge, dial and pointer type with diaphragm element. Black letters on white background, 4" diameter, with scale calibrated to permit direct reading of the airflow (in cfm) of the connected airflow measuring station. LCD readout with associated transmitter is acceptable.
- G. Manufacturers:
 1. Air Monitor Corporation.
 2. Farr.
 3. Ultratech Industries, Inc.
 4. Brandt.
 5. Tek-Air Systems, Inc.
 6. Ramsey Ventures.
 7. Ebtron.

2.07 AIRFLOW MEASURING PROBES – OUTSIDE AIRFLOW

- A. Duct airflow measuring probes shall be Thermal Dispersion type.
- B. Probes shall be constructed of extruded aluminum. Probes shall be provided with mounting plate, and gasket. Probe and mounting hardware shall facilitate easy removal and reinstallation of the probes.
- C. The number of sensors on each probe, and the quantity of probes provided at each location, shall comply with ASHRAE standards for duct traversing. Multiple probes provided at a single location shall be interconnected external to the duct to produce an average signal.
- D. For each airflow measurement location, the measured velocity pressure shall have accuracy within $\pm 2\%$ of the full scale throughout the velocity range of 0-4000 fpm.
- E. Associated transmitter at each airflow measurement location shall be provided with LCD readout to indicate with airflow (in CFM) of the connected airflow measuring station.
- F. Manufacturers / Model:
 - 1. Ebtron / Gold Series.
 - 2. Air Monitor Corporation / ELECTRA-flo.

2.08 INSTRUMENTATION TUBING

- A. Copper Tubing: ASTM B280 or ASTM B75, seamless, hard drawn or annealed.
 - 1. Fittings: ANSI/ASME B16.22, wrought copper.
 - 2. Joints: ANSI/ASTM B32, 95-5 tin antimony.
- B. Copper Tubing: ASTM B280 or ASTM B75, seamless, hard drawn or annealed.
 - 1. Fittings: UL approved rod or forged brass rated to 200 psig at 100 degrees F.
 - 2. Joints: Ball Sleeve compression type.
- C. Polyethylene Tubing: Black, UL 1820 flame and smoke retardant where exposed in an air plenum, virgin polyethylene, conforming to modified ASTM D1693 test. All non-metallic tubing shall be minimum 1/4" O.D.; micro-sleeve is not acceptable.
 - 1. Fittings: UL approved rod or forged brass rated to 200 psig at 100 degrees F.
 - 2. Joints: Compression or barbed type.

2.09 CONTROL VALVES AND VALVE OPERATORS

- A. Globe Valves (2-way & 3-way):
 - 1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, single seated, screwed ends with backseating capability, repackable under pressure.
 - 2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc, repackable under pressure.
 - 3. Valve stem packing shall be tetrafluorethylene, spring loaded and self-adjusting. Packless construction is acceptable.
 - 4. Manufacturers:
 - a. Belimo.
 - b. Johnson Controls.
 - c. Schneider Electric Controls.
 - d. Siemens.
- B. Electric Operators:
 - 1. Operators shall be electronic type to accept signals from direct digital controller or modulating thermostat for proportional control.
 - 2. Valves shall spring return to normal position as indicated.
 - 3. Select with sufficient shut-off power for system pressure and highest operating torque, and torque requirements of valves which may stick because of infrequent use.
 - 4. Select to provide smooth proportioning control under operating conditions normal to the system.
- C. Hydronic Systems:

1. Valve minimum pressure rating shall meet or exceed the system minimum pressure rating as noted for each system in Division 20 Section "Valves," and in Division 23 Section "Hydronic Piping."
2. Valve minimum temperature ratings shall be 212 deg F.
3. Two-way and three-way valves shall have equal percentage characteristics unless for diverting application which shall be linear. Size two-way valve operators to close valves against pump shut off head.
4. Pressure Drop for globe valves: As scheduled on the drawings. If not scheduled, primary HVAC equipment control valves shall be selected for a pressure drop close as possible to 11.5 feet of head (5 psi), +/- 10%; terminal equipment control valves shall be selected for a pressure drop close as possible to 6.9 feet of head (3-psi) with allowable minimum of 4.6 feet of head (2 psi) where flow rates are minimal and valve Cv choices are limited. TC Contractor shall use valves from listed manufacturers that meet the pressure drop requirements.

2.10 SOLENOID VALVES - GAS

- A. Performance: UL Listed to UL429 and FM Approved to Class 7400.
- B. Operation: Normally closed, soft-seat for tight close-off, 115VAC – 60Hz electric solenoid, line-sized, mountable in any position.
- C. Body: Aluminum
- D. Internal Parts: Stainless Steel
- E. Seals: NBR, PTFE
- F. Solenoid Enclosure: Explosion proof
- G. Manufacturers:
 1. ASCO.
 2. Parker
 3. Honeywell

2.11 DAMPERS - AUTOMATED

- A. Performance: Test in accordance with AMCA 500.
- B. Frames: Galvanized steel, minimum 16 gauge, minimum 2 inches in width, welded or riveted with corner reinforcement for 12 gage structural equivalence.
- C. Blades: Galvanized steel, minimum 14 gauge, maximum blade size 8 inches wide, 60 inches long, attached to minimum 1/2 inch shafts. Dampers which are required to have a static pressure rating over 4 inch W.G. shall have minimum 3/4 inch solid shafts.
- D. Blade Seals: Synthetic elastomeric or Neoprene, mechanically attached, field replaceable.
- E. Jackshafts (where required): Minimum 1/2 inch galvanized steel.
- F. Jamb Seals: Stainless steel.
- G. Bearings: Oil impregnated sintered bronze or lubricant free, solid stainless steel. Provide thrust washers at bearings for all dampers which are to be mounted with blades in the vertical position.
- H. Linkages: Accessible for maintenance. Linkages may be located in airstream. Linkages located in damper frame shall be external to the duct, accessible for maintenance. Linkages located in the airstream shall be zinc-plated.
- I. Leakage: Less than 8 CFM per square foot based on 4 inches W.G. pressure differential.
- J. Static Pressure Rating: As scheduled on the drawings, or if not scheduled, minimum 4" W.G.
- K. Maximum Velocity: As scheduled on the drawings, or design for maximum velocity to be encountered in location where installed.

L. Temperature Limits: -40 to 200 deg F.

M. Manufacturers:

1. American Warming & Ventilating.
2. Arrow United Industries.
3. Greenheck.
4. Honeywell.
5. Johnson Controls.
6. Louvers & Dampers, Inc.
7. Ruskin.
8. Tamco.
9. Vent Products.

2.12 DAMPER OPERATORS - ELECTRIC

- A. Electric damper motor shall be 24 or 120 volt two-position or modulating as required with spring return type and sized to operate the damper with sufficient reserve power for smooth operation from full close to full open and tight shut-off. Damper motor shall have "O ring" gaskets for weatherproof operation.
- B. Number: Sufficient to achieve unrestricted movement throughout damper range. Provide sufficient number of operators such that one operator does not operate more than the maximum square footage of damper area as recommended in standard catalog of manufacturer.
- C. Manufacturers:
 1. Belimo.
 2. Delta Control Products.
 3. Siemens.

2.13 LOCAL AND AUXILIARY CONTROL PANELS

- A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, pushbuttons and switches flush on cabinet panel face, or as detailed on drawings. Provide panel with locking door.
- B. ANSI/NEMA 250, general purpose utility enclosures with enameled finished face panel, or as indicated on the drawings.
- C. Panels shall be sized for a maximum fill of 50% capacity, and shall not be smaller than 24" X 24".

2.14 THERMOSTATS – ELECTRONIC & ELECTRIC

- A. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
 1. Automatic switching from heating to cooling
 2. Preferential rate control to minimize overshoot and deviation from setpoint
 3. Capable of providing four separate temperatures per day
 4. Instant override of setpoint for continuous or timed period from 1 hour to 31 days.
 5. Short-cycle protection.
 6. Programming based on every day of week.
 7. Selection features include degree F, 12- and 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
 8. Battery replacement without program loss.
 9. LCD features include the following:
 - a. Time of the day
 - b. Actual room temperature
 - c. Programmed temperature setpoints
 - d. Programmed time for occupied/unoccupied
 - e. Duration of timed override
 - f. Day of week

- g. System mode indications include "occupied", "unoccupied", "cooling", "heating," "off," "fan auto," and "fan on."
- B. Electric Low Limit Duct Thermostat (freezestat): Snap acting, auto-reset switch which trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint, fixed 5 deg F differential, range 30 deg F to 60 deg F, requiring minimum 20 feet length of bulb. Provide one thermostat for every 20 sq ft of coil surface. Switch shall be UL listed and rated for 10 amps at 120 VAC. Provide additional switch or contacts for connection to monitoring system.
 - 1. Manufacturers:
 - a. Honeywell.
 - b. Johnson Controls.
 - c. Siemens.
- C. Strap-on Aquastat: UL listed, with a suitable removable spring clip attaching aquastat to pipe and a snap-acting SPDT switch.
 - 1. Manufacturers:
 - a. Honeywell.
 - b. Johnson Controls.
 - c. Siemens.

2.15 STATUS SENSORS AND DEVICES - ELECTRIC

- A. Control Relay: Monitors or controls AC or DC motors or other equipment (as required), with cover, with visual indicator when energized, and two SPDT contacts rated 120/250 VAC at 8 Amps.
 - 1. Manufacturers:
 - a. Dayton.
 - b. Omron.
 - c. Functional Devices.
- B. Damper End Switch (limit switch):
 - 1. Oil-tight type with operator as required providing function. Limit switches used on dampers should be set at approximately 75% of full stroke.
 - 2. Manufacturers:
 - a. Allen-Bradley.
 - b. General Electric.
 - c. Square D.
 - d. Westinghouse.
 - e. Micro-switch.
- C. Emergency Power-Off (EPO) Push-button: ADA compliant, push-button switch with clear cover to prevent inadvertent closure. Push-to-activate push-button, key-to-reset feature, and providing two SPDT contacts rated 120/250 VAC at 10 Amps.
 - 1. Manufacturers:
 - a. Safety Technology International – model SS-2212PO
- D. Contactor: Electrically operated, mechanically held, relay mounted in NEMA-12 rated enclosure. Six (6) normally closed contacts rated 120/250 VAC at 20 Amps.
 - 1. Manufacturers:
 - a. Allen-Bradley
 - b. Cutler-Hammer
 - c. Square-D

2.16 ELECTRICAL REQUIREMENTS FOR CONTROLS WORK

- A. Electrical accessories such as relays, switches, contactors and control transformers shall meet the requirements of the Division 26 Specifications of respective project.
- B. Electrical wiring and conduit shall meet the requirements of the Division 26 Specifications.

- C. All control wiring in mechanical rooms and any other exposed areas shall be run in conduit. Low voltage temperature control wiring in concealed accessible locations (i.e. above lay-in ceilings), as well as low voltage temperature control wiring within partitions, may be run using plenum rated cable, neatly tie-wrapped and fastened to the building structure (not to ceiling or ceiling support wires).
- D. Conduits carrying control wiring shall be sized for a maximum fill of 40% of capacity.
- E. Where raceway is required, two separate raceway systems shall be provided; one for A.C. wiring and the other for D.C. wiring.
- F. Data transmission cabling and equipment grounding procedures shall meet the latest FCC guidelines for electromagnetic field generation.
- G. All control wiring sizes and types shall meet or exceed the equipment manufacturer's recommendations.

PART 3 EXECUTION

3.01 INSTALLATION - CONTROL SYSTEMS

- A. Install in accordance with manufacturer's instructions.
- B. Check and verify location of temperature sensors and other exposed control sensors with plans and room details before installation. Locate room temperature sensors 48 inches above floor unless noted otherwise.
- C. The location of all control-related items to be mounted on the exterior of the building must be approved by the Architect prior to installation. Indicate proposed locations on the shop drawings.
- D. Caulk both sides of damper frames to duct walls to prevent leakage between damper frame and duct.
- E. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. Sensors used for closed loop control must be connected to the same DDC panel as the associated output signal.
- F. Provide conduit and electrical wiring where required.
- G. All wiring in altered and unaltered areas shall be run concealed. "Wiremold" in finished areas shall be allowed when wiring cannot be run concealed in walls or partitions. Minimize "wiremold" routing.
- H. Splicing of DDC sensor cabling at junction boxes shall not be acceptable.
- I. All equipment which has moving parts and is remotely started by the control system shall be provided with warning labels no less than 2 inches in height, and in bright warning color, stating that the equipment is remotely started by automatic controls. Such labels shall be posted clearly in the area of any moving parts, such as belts, fans, pumps, etc.
- J. Coil and conceal excess capillary on remote element instruments.
- K. Locate all control components and accessories such that they are easily accessible for adjustment, service and replacement.
- L. Locate, size, and support sensing elements in airstreams so that they properly sense the representative condition. Controlling, transmitting and indicating elements shall be located to sense the average condition. Safety elements shall be located to sense the extreme condition.
- M. Locate and size sensing elements in liquid lines so that they are in moving liquid and not in stagnant or turbulent locations. Wells shall not obstruct the flow of the liquid being measured. Pipes one inch and smaller shall be increased at least one pipe size at the point of insertion.
- N. Locate, support and install all control components and accessories so that they will not be subject to vibration, excessive temperatures, dirt, moisture or other harmful conditions beyond their rated limitations.

- O. Where insulation is penetrated due to the installation of sensing elements or tubing, reseal the openings air and vapor tight. Provide brackets for devices to be located on insulated surfaces so as to clear the finished surface of the insulation and to avoid puncturing the vapor seal.
- P. Provide all necessary relays, switches, linkages, control devices, accessories and connections as required for a complete and operational control system as specified herein and shown.
- Q. All electric valve and damper operators shall be capable of moving from full closed to full open, or vice versa, within 120 seconds.

3.02 TC CONTRACTOR DESIGN & INSTALLATION COORDINATION MEETINGS

- A. Temperature Controls Shop Drawing Pre-submittal Meeting: TC Contractor's option to schedule a meeting at the Engineer's Office to review project design documentation for clarification purposes to aide in the TC Contractor development of TC/BAS shop drawings. For simple clarification items, TC Contractor may contact Engineer via telephone to discuss. For project scope questioning items, TC Contractor shall utilize the formal Request of Information (RFI) process.
- B. Temperature Controls Shop Drawing Submittal Meeting: Project Design Engineer's option to schedule a meeting at the Engineer's Office to review the TC Contractor's formally submitted drawings to address Engineer's comments and concerns that indicate TC Contractor's shop drawings vary from project design intent. This meeting can be avoided if TC Contractor's shop drawing submittal is complete and Engineer is confident that documents are going to lead to an installation that meets project design intent.
- C. Temperature Controls Installation Technician Meeting: Project Design Engineer's option to schedule a meeting at the project site to meet and discuss project expectations with the TC Contractor's field installation technician and/or project manager. Discussion may include
 - 1. Shop drawing review comments to ensure installation technician has the most up-to-date TC submittal.
 - 2. Graphics generation requirements including special Owner requirements and schedule for completion.
 - 3. Owner training agenda and scheduling.
 - 4. TC/BAS system acceptance procedures.

3.03 IDENTIFICATION AND MARKING

- A. All sensors, relays, switches, etc. shall be marked with the same identification number as used on the as-built shop drawings. Use Brother P-touch label maker or similar with black text on clear or white super adhesive tape. If label applied in wet environment, spray label with clear enamel for waterproofing.
- B. Wire shall be color coded according to functional use. Identify color coding format on record drawings.
- C. Identify each wire as to ID number at each control panel, field device, and splice.
- D. All control panels and auxiliary enclosures shall be supplied with engraved phenolic nameplate permanently attached identifying it as control panel number, system served, area served, fed from receptacle panel number, circuit number, etc.

3.04 GRAPHIC DISPLAY GENERATION

- A. Provide the following graphic displays as a minimum for operator interface, arranged in logical penetration paths. Modify, copy, or expand the existing graphics associated with building as required to allow operator interface to newly installed equipment. Remove graphics associated with equipment that may have been eliminated with project scope of work:
 - 1. Floor plans for each floor within each building, with display of present values of space conditions sensed by connected space sensors, display of the name of the air handler

- associated with each space sensor, display of the room number in which the sensor is located and color coding to indicate whether the sensed space condition is within the acceptable range, is too high, or is too low. TC Contractor shall confirm Owner desired room names prior to graphics generation which may differ from the room names indicated on construction documents.
2. Schematic diagram for each HVAC system. Each system schematic display shall include at least the following:
 - a. Schematic arrangement of ductwork, fans, dampers, coils, valves, piping, pumps, equipment etc.
 - b. System name.
 - c. Area served.
 - d. Present value or status of all inputs, along with present setpoint.
 - e. Present percent open for each damper, valve, etc. based on commanded position.
 - f. Reset schedule parameters for all points, where applicable.
 - g. Present occupancy mode.
 - h. Present economizer mode, where applicable.
 - i. Present outside air temperature.
 - j. Associated space conditions and setpoints, where applicable.
 - k. Status of application programs (e.g., warm-up, night cycle, duty cycle, etc.).
 - l. Color coding to indicate normal and abnormal values, alarms, etc.
 3. Manual override capability for each on/off or open/closed controlled digital output (for fans, pumps, 2-position dampers and valves, etc.) and each modulating analog output (for dampers, valves, VFC speed modulation type points, etc) shall be provided. Graphic display of output point auto or manual override status shall be provided.
 4. Sequence of operation in written (text) format for each HVAC system.
 5. Overall BAS system schematic.
 6. System management graphic for each network device and/or DDC panel.

3.05 OWNER INSTRUCTION AND TRAINING

- A. Provide a minimum of four (4) hours of on-site instruction and training to the Owner for each building on the operation of the control systems for the initial installation.
- B. Instruction and training shall be performed by a competent Contractor representative familiar with the control systems operation, maintenance and calibration.
- C. Training shall take place after check, test, start-up of temperature controls system at a time mutually agreed upon by the Owner and Contractor.

3.06 CALIBRATION AND START-UP

- A. After installation and connection of control components, test, adjust and re-adjust as required all control components in terms of function, design, systems balance and performance. Make systems ready for environmental equipment acceptance tests.
- B. After environmental equipment has been accepted and after the systems have operated in normal service for two weeks, check the adjustment on control components and recalibrate where required. Components not in calibration shall be recalibrated to function as required, or shall be replaced. Control devices, linkages, and other control components shall be calibrated and adjusted for stable and accurate operation in accordance with the design intent and to obtain optimum performance from the equipment controlled. Cause every device to automatically operate as intended to ensure its proper functionality.

3.07 ACCEPTANCE PROCEDURE

- A. Upon successful completion of start-up and recalibration as indicated in this section, the Architect shall be requested in writing to inspect the satisfactory operation of the control systems.

- B. Demonstrate operation of all control systems, including each individual component, to the Owner and Architect.
- C. After correcting all items appearing on the punch list, make a second written request to the Owner and Architect for inspection and approval.
- D. After all items on the punch list are corrected and formal approval of the control systems is provided by the Architect, the Contractor shall indicate to the Owner in writing the commencement of the warranty period.

END OF SECTION 23 09 33

SECTION 23 21 13 HYDRONIC PIPING

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 DEFINITIONS	1
1.03 SYSTEMS DESCRIPTIONS	2
1.04 SUBMITTALS	2
1.05 QUALITY ASSURANCE	2
PART 2 PRODUCTS	2
2.01 COPPER TUBE AND FITTINGS	2
2.02 JOINING MATERIALS	2
2.03 TRANSITION FITTINGS	2
2.04 VALVES	2
2.05 SPECIALTY VALVES	2
2.06 CONTROL VALVES	3
2.07 AIR CONTROL DEVICES	3
2.08 HYDRONIC PIPING STRAINERS	3
PART 3 EXECUTION	3
3.01 PIPING SYSTEMS INSTALLATION	3
3.02 HANGERS AND SUPPORTS	4
3.03 PIPE JOINT CONSTRUCTION	5
3.04 HYDRONIC SPECIALTIES INSTALLATION	5
3.05 TERMINAL EQUIPMENT CONNECTIONS	5
3.06 FIELD QUALITY CONTROL	5

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 07 Section "Through-Penetration Firestop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.
 2. Division 07 Section "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.
 3. Division 20 Section "Mechanical General Requirements."
 4. Division 20 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
 5. Division 20 Section "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
 6. Division 20 Section "Mechanical Identification" for labeling and identifying hydronic piping.
 7. Division 23 Section "General-Duty Valves for HVAC" for general-duty gate, globe, ball, butterfly, and check valves.
 8. Division 23 Section "Temperature Controls" for temperature-control valves and sensors.

1.02 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride.
- B. HDPE: High density polyethylene.
- C. PP: Polypropylene.
- D. PVC: Polyvinyl chloride.
- E. PTFE: Polytetrafluoroethylene.

- F. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
- G. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.03 SYSTEMS DESCRIPTIONS

- A. Hydronic piping system materials are scheduled on the Drawings.
- B. Refer to Application Schedule on the Drawings for valve types to be used.

1.04 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
 - 2. Air control devices.
 - 3. Chemical treatment.
 - 4. Hydronic specialties.
- B. Shop Drawings: Detail, at minimum 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Qualification Data: For Installer.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in operation and maintenance manuals.
- F. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.05 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- B. Installer Qualifications:

PART 2 PRODUCTS

2.01 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Wrought-Copper Socket Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.

2.02 JOINING MATERIALS

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods."

2.03 TRANSITION FITTINGS

2.04 VALVES

- A. General Service Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC."

2.05 SPECIALTY VALVES

- A. Balance Valves:
- B. Combination, Balancing Valves and Flow Measuring Devices NPS 2 and Smaller:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flow Design Inc.
 - b. Griswold Controls.

- c. Hydronic Components, Inc. (HCi).
 - d. Nexus Valve.
 - e. PRO Hydronic Specialties, LLC.
- 2. Body: Brass or bronze, ball or plug type with calibrated orifice or venturi.
- 3. Ball: Plated brass, or stainless steel.
- 4. Plug: Resin.
- 5. Seat: PTFE.
- 6. End Connections: Threaded or socket.
- 7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
- 8. Handle Style: Lever, with memory stop to retain set position.
- 9. WOG Rating: Minimum 400 psig.
- 10. Maximum Operating Temperature: 250 deg F.
- C. Contractor Option for Combination, Balancing Valves and Flow Measuring Devices NPS 2 and Smaller: Preamsembled coil hook up kits may be used.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flow Design Inc.; Complete Coil Hook-Up.
 - b. Griswold Controls.
 - c. Hydronic Components, Inc. (HCi).
 - d. Nexus Valve; Coil Pak.
 - e. PRO Hydronic Specialties, LLC.

2.06 CONTROL VALVES

- A. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Temperature Controls."

2.07 AIR CONTROL DEVICES

- A. Manual Air Vents: Use ball-valve-type hose-end drain valves, refer to Division 20 Section "Valves."

2.08 HYDRONIC PIPING STRAINERS

- A. Manufacturers:
 - 1. Keckley.
 - 2. Metraflex.
 - 3. Mueller Steam Specialty.
 - 4. Nibco, Inc.
 - 5. Spence.
 - 6. Sure Flow Equipment Inc.
 - 7. Watts Water Technologies, Inc.
 - 8. Yarway.
- B. Y-Pattern Strainers, Bronze:
 - 1. CWP: 200 psig minimum, unless otherwise indicated.
 - 2. SWP: 125 psig minimum, unless otherwise indicated.
 - 3. Body: Bronze for NPS 2 and smaller.
 - 4. End Connections: Threaded or soldered.
 - 5. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - 6. Drain:
 - a. Pipe plug for sizes NPS 2 and smaller.
 - b. Factory-installed, hose-end drain valve for sizes NPS 2-1/2 and larger.

PART 3 EXECUTION

3.01 PIPING SYSTEMS INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such 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. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping, other than drain piping, at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC."
- Q. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
- R. Install calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.
- S. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- T. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and where indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- U. Identify piping as specified in Division 20 Section "Mechanical Identification."

3.02 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 20 Section "Hangers and Supports." Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
- C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.

3.03 PIPE JOINT CONSTRUCTION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.04 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

3.05 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.

3.06 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- B. Perform the following tests on hydronic piping:
 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 3. Isolate expansion tanks and determine that hydronic system is full of water.
 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
 5. After hydrostatic test pressure has been applied for at least 2 hours, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 6. Prepare written report of testing.
- C. Perform the following before operating the system:
 1. Open manual valves fully.
 2. Inspect pumps for proper rotation.
 3. Remove disposal fine-mesh strainers in pump suction diffusers.
 4. Set makeup pressure-reducing valves for required system pressure.
 5. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 6. Set temperature controls so all coils are calling for full flow.
 7. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.

8. Verify lubrication of motors and bearings.

END OF SECTION 23 21 13

SECTION 23 25 10 – PIPING SYSTEMS FLUSHING AND CHEMICAL CLEANING

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS.....	1
1.02 SUMMARY	1
1.03 DEFINITIONS.....	1
1.04 PERFORMANCE REQUIREMENTS	1
1.05 SUBMITTALS	1
1.06 QUALITY ASSURANCE.....	2
1.07 COORDINATION.....	2
PART 2 PRODUCTS	2
2.01 MANUFACTURERS	2
2.02 MATERIALS	2
PART 3 EXECUTION.....	2
3.01 ACCEPTABLE SERVICE PROVIDER	2
3.02 PREPARATION	3
3.03 INITIAL FLUSHING	3
3.04 FLUSHING AND CHEMICAL CLEANING PROCEDURES	3
3.05 PLACING INTO OPERATION	4
3.06 FIELD QUALITY CONTROL	4

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."
 - 2. Division 20 Section "Basic Mechanical Materials and Methods."
 - 3. Division 22 Section "Domestic Water Piping," for disinfection of potable water piping.
 - 4. Division 23 Section "Hydronic Piping."

1.02 SUMMARY

- A. This Section includes chemical cleaning for the following piping systems:
 - 1. Heating hot water.

1.03 DEFINITIONS

- A. Cleaning: Recirculating water containing chemical cleaning and passivation compounds.
- B. Flushing: Using approved water on a once through basis.

1.04 PERFORMANCE REQUIREMENTS

- A. Furnish the services of a firm specializing in piping system chemical cleaning and water treatment work.
 - 1. For chemical cleaning: This firm shall select the required type and quantity, based on system volume, of cleaning compound, and method of application.

1.05 SUBMITTALS

- A. Product Data:
 - 1. Proposed cleaning chemicals and quantities.
 - 2. Analyses and reports of all chemical items concerning safety and compliance with government regulations.
- B. Shop Drawings: Reduced scale plans indicating locations of velocity measurements.
- C. Field quality-control test reports.
- D. Other Informational Submittals:
 - 1. Proposed, step-by-step, chemical cleaning procedure.

2. Circulation pump suction and discharge pressure at start and completion of chemical cleaning operations.

1.06 QUALITY ASSURANCE

- A. Service Provider Qualifications: An experienced piping systems cleaning service provider capable of applying cleaning compounds as specified in this Section.
- B. Conduct safety meetings with Owner's Representative and personnel involved in the cleaning process.
- C. Assume responsibility for damage, necessary subsequent cleaning, flushing, and inspection of Work under the Contract which results from improper flushing and cleaning operations including failure to flush all dead-ends.

1.07 COORDINATION

- A. Schedule flushing and chemical cleaning activities immediately after piping system pressure testing and immediately prior to piping system chemical treatment work to minimize internal oxidization or flash corrosion of piping systems.
- B. Coordinate chemical cleaning work with other work to avoid accidental chemical discharge, spillage, or spray out, and electrolytically originated system damage resulting from concurrent chemical cleaning and arc welding.
- C. Coordinate with work performed under other Sections to provide in-place temporary strainers, spool pieces, flushing hose connections, cross-over piping, and isolation and drain valves.
- D. Chillers shall not be cleaned with any chloride component.
- E. Boilers shall be flushed and cleaned to remove rust and oil deposits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. System Cleaning Chemicals: Subject to compliance with requirements, provide products by one of the following:
 1. PVS-Nolwood Chemicals, Inc.; PVS CHILL CLP Cleaner.
 2. Nalco Company; Nalco 2578.
 3. Mitco Custom Water Treatment.
 4. H-O-H Chemicals, Inc.
 5. GE Power & Water; Water & Process Technologies.
 6. Enerco Corporation.

2.02 MATERIALS

- A. Cleaning chemicals shall be as recommended by manufacturer and compatible with piping system components and connected equipment.
- B. Cleaning and passivation chemical shall consist of an inorganic phosphate, yellow metal corrosion inhibitor (Tolytriazole), dispersant, and oil emulsifier.
- C. Provide additional temporary and permanent piping, equipment, and materials required for chemical cleaning work.
- D. Use potable water for flushing and cleaning operations, unless directed otherwise by the Architect.

PART 3 EXECUTION

3.01 ACCEPTABLE SERVICE PROVIDER

- A. Subject to compliance with requirements, provide chemical cleaning service by one of the following:
 1. Eldon Water (Patrick Racine, Christa Blades, or Pierre Beausoleil, 888-712-4000).
 2. Enerco Corporation (Doug White 517-627-8444 or 800-292-5908).
 3. GE Power & Water; Water & Process Technologies.
 4. Mitco Custom Water Treatment (Gordon Chapin, 800-516-2175)

5. Nalco Company (Brian Irwin or Tony Mackovski, 248-344-7564)
6. H-O-H Chemicals, Inc. (H.V. Burton Co.)

3.02 PREPARATION

- A. Prior to flushing and cleaning activities, drain the system of all water used for hydrostatic testing.
- B. Temporarily connect dead-end supply and return piping as necessary to result in recirculating system in which no lines are left static for purposes of flushing and cleaning. Refer to System Piping Diagrams on the Drawings for suggested locations of temporary connections for flushing and cleaning purposes.
- C. Select three locations for monitoring flow rates.

3.03 INITIAL FLUSHING

- A. Remove loose dirt, mill scale, metal chips, weld beads, rust and other deleterious substances without damage to system components.
- B. Bypass factory cleaned equipment, unless acceptable means of protection are provided and subsequent inspection of water boxes and other "hide-out" areas takes place.
- C. Isolate or protect clean system components including pumps and pressure vessels and remove components which may be damaged.
- D. Open valves, drains, vents and strainers at all system levels.
- E. Remove plugs, caps, spool pieces and components to facilitate early discharge from system.
- F. Sectionalize system if possible to obtain debris carrying velocity of 6 FPS.
- G. Connect dead-end supply and return headers as necessary or provide terminal drains in end caps.
- H. Install temporary strainers where necessary to protect down-stream equipment.
- I. Supply and remove flushing water and drainage by fire hoses, garden hoses, temporary and permanent piping and Contractor's booster pumps.
- J. Flush for not less than one hour.
- K. Inspect system including basins to determine if debris accumulation requires dewatering and cleaning prior to next phase work.

3.04 FLUSHING AND CHEMICAL CLEANING PROCEDURES

- A. Remove without chemical or mechanical damage to system components adherent dirt (organic soil), oil and grease (hydrocarbons), welding and soldering flux, mill varnish, pipe compounds, rust (iron oxide), and other deleterious substances not removed by initial flushing. Removal of tightly adherent mill scale is not required.
- B. Fill system with fresh water and add manufacturer's recommended volume of system cleaner to remove grease and petroleum products from piping. Circulate solution for 48 hours at a minimum velocity of 6 fps.
 1. Utilize defoamers to preclude damage to existing work and adjacent electrical equipment.
 2. Utilize heat to maximize effectiveness of compounds or use live steam injection where practical and safe. Do not raise cleaning water temperature in excess of controlled limits.
- C. Monitor flow rates and clean strainers as required to maintain minimum specified velocity during the entire circulation and chemical cleaning period.
- D. Cleaning of new piping systems shall be completed prior to connection of systems to existing services.
- E. Install temporary strainer screens between pipe flange faces where necessary to protect primary system from branch connections during chemical cleaning procedures.
- F. Following chemical cleaning:
 1. Remove, clean, and reinstall strainer baskets.

2. Blow down and clean low points, dirt legs, and traps.
- G. Drain systems:
 1. Check with local authorities concerning discharge requirements and submit copies of letters or reports.
 2. If acceptable, drain system to sanitary drainage system.
 3. Do not under any circumstances drain to storm drainage system or open drainage ditch.
 4. If discharge requirements do not allow discharge to sanitary sewer, secure the services of a licensed disposal Contractor.
 5. Disposal Contractors:
 - a. Dynecol.
 - b. SQS Environmental.
- H. Perform final flush to remove any remaining debris and chemical from the system:
 1. Flush dead ends and isolated pre-cleaned equipment.
 2. Operate valves to dislodge debris in valve body.
 3. Flush for not less than 1 hour.

3.05 PLACING INTO OPERATION

- A. Clean strainers.
- B. Dewater and clean new sumps, basins, storage vessels and pressure vessels.
- C. Disassemble, inspect, clean, repair, replace and reassemble any critical component or questionable item. Bellows style, and hose and braid flexible connectors left in place shall be removed and cleaned.
- D. Preliminarily adjust control valves.
- E. Install clean primary filter elements, if necessary, as determined by both pressure differential across filter and visual inspection of filter elements.
- F. Close-up and fill system as soon as possible to minimize corrosion of untreated surfaces.
- G. Vent air from system and adjust fill valve.
- H. Immediately after completion of flushing and chemical cleaning, fill systems with potable water and make ready for chemical treatment as specified in Division 23 Section "HVAC Water Treatment."

3.06 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Withdraw, inspect, and test samples of water from each system after flushing and chemical cleaning is completed, to ensure system is free of contaminants.
 2. If loose debris or contaminants are still present, repeat final flushing procedures until test samples and strainers remain free of debris and contaminants.

END OF SECTION 23 25 10

SECTION 23 31 13 METAL DUCTS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	1
1.04 SYSTEM DESCRIPTION	2
1.05 PERFORMANCE REQUIREMENTS	2
1.06 SUBMITTALS	2
1.07 QUALITY ASSURANCE	2
1.08 COORDINATION	2
PART 2 PRODUCTS	3
2.01 MANUFACTURERS	3
2.02 SHEET METAL MATERIALS	3
2.03 SEALANTS AND GASKETS	3
2.04 HANGERS AND SUPPORTS	4
2.05 RECTANGULAR DUCT FABRICATION	5
2.06 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION	5
PART 3 EXECUTION	7
3.01 DUCTWORK APPLICATION SCHEDULE	7
3.02 DUCT INSTALLATION	7
3.03 INSTALLATION OF EXPOSED DUCTWORK	8
3.04 DUCT SEALING	8
3.05 HANGING AND SUPPORTING	8
3.06 CONNECTIONS	9
3.07 PAINTING	9
3.08 FIELD QUALITY CONTROL	9
3.09 START UP	9

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."
 - 2. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.02 SUMMARY

- A. This Section includes metal ducts for supply, return, outside, relief air, and exhaust air-distribution systems in pressure classes from minus 6- to plus 6-inch wg.

1.03 DEFINITIONS

- A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain sizes inside lining.
- B. Low Pressure: Up to 2 inch WG and velocities less than 1,500 fpm. Construct for 2 inch WG positive or negative static pressure.
- C. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm. Construct for 6 inch WG positive or negative static pressure.
- D. High Pressure: Greater than 6 inch WG to 12 inch WG and velocities greater than 2,500 fpm. Construct for 12 inch WG positive or negative static pressure.

1.04 SYSTEM DESCRIPTION

1.05 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Application Schedule" Article.

1.06 SUBMITTALS

- A. Shop Drawings: **Drawn** to 1/4 inch equals 1 foot scale. Show fabrication and installation details for metal ducts. Shop drawings shall be reviewed and approved by the Architect prior to any fabrication.
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Duct layout indicating sizes and pressure classes.
 - 3. Elevations of top and bottom of ducts.
 - 4. Dimensions of main duct runs from building grid lines.
 - 5. Fittings.
 - 6. Reinforcement and spacing.
 - 7. Seam and joint construction.
 - 8. Penetrations through fire-rated and other partitions.
 - 9. Equipment installation based on equipment being used on Project.
 - 10. Duct accessories, including access doors and panels.
 - 11. Hangers and supports, including methods for duct and building attachment, vibration isolation.
- B. Delegated-Design Submittal:
 - 1. Sheet metal thicknesses.
 - 2. Joint and seam construction and sealing.
 - 3. Reinforcement details and spacing.
 - 4. Materials, fabrication, assembly, and spacing of hangers and supports.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Other systems installed in same space as ducts.
 - 3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
 - 4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Welding certificates.
- E. Field quality-control test reports.

1.07 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. NFPA Compliance:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.08 COORDINATION

- A. Sheet metal trades shall cooperate fully with the Laboratory Airflow Controls Trades and shall attend all field installation training sessions.
- B. Sheet metal trades shall cooperate fully with the Test and Balance Contractor and provide all miscellaneous caps and any other materials required for structural integrity and leakage testing

of the complete duct system in whole or in part. Refer to Division 23 Section "Testing, Adjusting and Balancing."

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
- C. Sheet metal trades shall participate in the above ceiling coordination program. Refer to Division 01 requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- E. Tie Rods: For rectangular ducts having a side dimension of 48 inches or greater. Galvanized steel, 3/8-inch minimum diameter.

2.03 SEALANTS AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Elastomeric Sealant Tape: 3 inches wide; modified butyl adhesive backed.
1. Manufacturers:
 - a. Hardcast; Foil-Grip 1402 and Foil-Grip 1402-181BFX.
- C. Water-Based Joint and Seam Sealant:
1. Manufacturers:
 - a. Hardcast; Flex-Grip 550 and Versa-Grip 181.
 - b. Polymer Adhesives; No. 11.
 - c. United McGill.
 2. Application Method: Brush on.
 3. Solids Content: Minimum 65 percent.
 4. Shore A Hardness: Minimum 20.
 5. Water resistant.
 6. Mold and mildew resistant.
 7. VOC: Maximum 75 g/L (less water).
 8. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 9. Service: Indoor or outdoor.
 10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare).
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.

4. Class: 25.
 5. Use: O.
- E. Gaskets: Chloroprene elastomer, 40 durometer, 1/8 inch thick, full face, one piece vulcanized or dovetailed at joints.
- F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.04 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
 2. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 3. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
 4. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials. Attachments for stainless steel and PVC-coated duct shall be stainless steel.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
 3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.
- E. Load Rated Cable Suspension System for Noncorrosive Environments: Tested to five times the Safe Working Loads and verified by the SMACNA Testing and Research Institute.
1. Cable: Aircraft quality 7 x 7 and 7 x 19 wire rope.
 - a. Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
 - b. Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
 2. Fastener: One-piece, die-cast zinc housing with Type 302 S26 stainless steel hardened and tempered springs, and oil impregnated, sintered, hardened and tempered steel locking wedges.
 3. End Fixings: Loop, stud or toggle; or plain end suitable for wire rope beam clamp.
 4. Manufacturers:
 - a. Ductmate Industries, Inc.; Clutcher and EZ-Lock.
 - b. Duro Dyne Corp.; Dyna-Tite System.
 - c. Gripple Inc.; Hang-Fast System.
- F. Stainless Steel Load Rated Cable Suspension System for Corrosive Environments: Tested to five times the Safe Working Loads and verified by the SMACNA Testing and Research Institute.
1. Cable: Aircraft quality stainless steel 7 x 7 and 7 x 19 wire rope.
 - a. Stainless steel complying with ASTM A 492.
 2. Fastener: One-piece, stainless steel housing with Type 302 S26 stainless steel hardened and tempered springs, and ceramic locking wedges.
 3. End Fixings:
 - a. Loop End: Type 316L/A4 stainless steel.
 - b. Stud or Toggle End: Type 304L/A2 stainless steel.

- c. Plain end suitable for stainless steel wire rope beam clamp.
- 4. Manufacturers:
 - a. Ductmate Industries, Inc.; Clutcher and EZ-Lock.
 - b. Duro Dyne Corp.; Dyna-Tite System.
 - c. Gripple Inc.; Hang-Fast System.
- G. Welded Supports: Structural steel shapes with zinc rich paint. Equivalent, proprietary design, rolled steel structural support systems may be used in lieu of mill rolled structural steel.

2.05 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
 - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 - 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
 - 3. Internal Tie Rod: Ducts having a side dimension of 48 inches or greater only.
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's and SMACNA guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
 - 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Nexus Inc.
 - c. Ward Industries, Inc.
- C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.06 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

- A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.
- B. Round and Flat-Oval, Spiral Lock-Seam Ducts:
 - 1. Manufacturers:
 - a. Eastern Sheet Metal (ESM).
 - b. LaPine Metal Products.
 - c. Lindab Inc.
 - d. McGill AirFlow Corporation.
 - e. SEMCO Incorporated.
 - f. SET Duct Manufacturing, Inc.
 - g. Tangent Air, Inc.
 - h. Universal Spiral Air.
- C. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" or SMACNA "Industrial Duct Construction Standards" as required based on pressure class.
 - 1. Round fittings shall be factory fabricated welded design. Use of field fabricated fittings (welded design) shall only be permitted when factory fabricated fittings are unavailable.
- D. Flat-Oval, Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" or SMACNA "Industrial Duct Construction Standards" as required based on pressure class.
 - 1. Flat-oval fittings shall be factory fabricated welded design. Use of field fabricated fittings (welded design) shall only be permitted when factory fabricated fittings are unavailable.
- E. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
 2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
 3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
 4. Bolts and fasteners for galvanized steel duct shall be carbon steel, zinc coated per ASTM A153. Bolts and fasteners for stainless steel and polyvinyl chloride coated steel duct shall be stainless steel.
 5. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
 - a. Manufacturers:
 - 1) AccuDuct Mfg. Inc.
 - 2) Ductmate Industries, Inc.
 - 3) Eastern Sheet Metal (ESM).
 - 4) Lindab Inc.
 - 5) Universal Spiral Air.
 6. Flat-Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.
 - a. Manufacturers:
 - 1) AccuDuct Mfg. Inc.
 - 2) Ductmate Industries, Inc.
 - 3) Eastern Sheet Metal (ESM).
 - 4) McGill AirFlow Corporation.
 - 5) SEMCO Incorporated.
 - 6) Universal Spiral Air.
- F. Low Pressure Ductwork (plus or minus 2 inches W.G. Static Pressure Class)
1. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible provide single thickness turning vanes.
 2. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
- G. Medium and High Pressure Ductwork (For Static Pressure Class Greater than plus or minus 2 inches W.G.)
1. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible provide single thickness turning vanes.
 2. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.
 3. Fabricate continuously welded medium and high pressure round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
 4. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- H. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- I. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- J. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
 - a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
 - b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
 - c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
 - d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
 - a. Ducts 3 to 26 Inches in Diameter: 0.034 inch.
 - b. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
 - c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
 - d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct.
5. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
6. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
8. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
9. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
10. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
11. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.
12. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.

PART 3 EXECUTION

3.01 DUCTWORK APPLICATION SCHEDULE

- A. Ductwork materials and performance requirements are scheduled on the Drawing.

3.02 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, and sleeves. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories."
- O. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.
- P. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
 - 1. Intermediate level.

3.03 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.04 DUCT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated. Ducts must be properly cleaned and sealed in strict accordance with sealant manufacturer's instructions.
 - 1. Seal Class: Refer to Application Schedule on the Drawings.
 - 2. Seal ducts before external insulation is applied.
 - 3. After pressure testing, remake leaking joints until leakage is equal to or less than maximum allowable. Refer to Application Schedule on the Drawings for allowable leakage rates.

3.05 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet and at each floor.
- C. Install concrete inserts before placing concrete.

- D. Support ductwork from building structure, not from roof deck, floor slab, pipe, other ducts, or equipment.
- E. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- F. Install roof mounted duct supports in accordance with manufacturer's instructions. Provide additional membrane layer or walkpads under support bases as required.
- G. Use load rated cable suspension system for round duct in exposed locations.

3.06 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.07 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.08 FIELD QUALITY CONTROL

- A. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
- B. Duct system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.09 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION 23 31 13

SECTION 23 33 00
DUCT ACCESSORIES

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS.....	1
1.02 DEFINITIONS.....	1
1.03 SUBMITTALS	1
1.04 QUALITY ASSURANCE.....	2
1.05 EXTRA MATERIALS	2
PART 2 PRODUCTS	2
2.01 MANUFACTURERS.....	2
2.02 SHEET METAL MATERIALS	2
2.03 LOW PRESSURE MANUAL VOLUME DAMPERS	2
2.04 MOTORIZED CONTROL DAMPERS	3
2.05 FIRE DAMPERS (CURTAIN STYLE).....	3
2.06 FIRE DAMPERS (MULTIPLE BLADE TYPE)	4
2.07 SMOKE DAMPERS.....	4
2.08 COMBINATION FIRE AND SMOKE DAMPERS	5
2.09 DUCT SILENCERS (FIBERGLASS FILL).....	6
2.10 TURNING VANES	7
2.11 DUCT-MOUNTING ACCESS DOORS.....	7
2.12 FLEXIBLE CONNECTORS	8
2.13 FLEXIBLE DUCTS, LOW AND MEDIUM PRESSURE	8
2.14 FLEXIBLE DUCT ELBOW SUPPORTS.....	9
2.15 DUCT ACCESSORY HARDWARE.....	9
2.16 FINISHES	9
PART 3 EXECUTION.....	9
3.01 APPLICATION AND INSTALLATION	9
3.02 FIELD QUALITY CONTROL	11
3.03 ADJUSTING	11

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."
 - 2. Division 23 Section "Testing, Adjusting, and Balancing" for duct test holes.
 - 3. Division 23 Section "Temperature Controls" for motorized control dampers.
 - 4. Division 28 Section "Fire Alarm" for duct-mounting fire and smoke detectors.

1.02 DEFINITIONS

- A. NVLAP: National Voluntary Laboratory Accreditation Program.
- B. Low Pressure: Up to 2 inch WG and velocities less than 1,500 fpm. Construct for 2 inch WG positive or negative static pressure.
- C. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm. Construct for 6 inch WG positive or negative static pressure.
- D. High Pressure: Greater than 6 inch WG to 12 inch WG and velocities greater than 2,500 fpm. Construct for 12 inch WG positive or negative static pressure.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For turning vanes, include data for pressure loss generated sound power levels.

2. For duct silencers, include pressure drop and dynamic insertion loss data.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Duct security bars.
 - f. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.
- D. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.05 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed for each temperature rating.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
- E. Bird Screens: No. 2 mesh, 0.063 inch diameter galvanized wire screen with open area of not less than 72 percent. Conceal sharp edges by adding metal edging consisting of rod, flat or angle iron, or 16 gage galvanized sheet steel turned over at least 3/4 inch on both sides.

2.03 LOW PRESSURE MANUAL VOLUME DAMPERS

- A. Manufacturers:
 1. American Warming and Ventilating.

2. Arrow United Industries.
 3. Greenheck.
 4. Krueger.
 5. Louvers and Dampers.
 6. Nailor Industries Inc.
 7. Ruskin Company.
 8. Vent Products Company, Inc.
 9. Young Regulator Company.
- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
1. Except for dampers in round ductwork sized 12 inches and smaller, provide end bearings.
- C. Rectangular Volume Dampers: Multiple-opposed-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.
- D. Round Volume Dampers 16-inch Diameter and Smaller: Single-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.
- E. Round Volume Dampers Larger than 16-inch Diameter: Multiple-opposed-blade design AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.
- F. Damper Materials:
1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
 3. Blade Axles: Galvanized steel.
 4. Bearings: Oil-impregnated bronze, molded synthetic, or stainless-steel sleeve type.
 5. Tie Bars and Brackets: Galvanized steel.
- G. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- H. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.04 MOTORIZED CONTROL DAMPERS

- A. Refer to Division 23 Section "Temperature Controls."

2.05 FIRE DAMPERS (CURTAIN STYLE)

- A. Manufacturers:
1. Air Balance, Inc.
 2. Greenheck.
 3. NCA Manufacturing, Inc.
 4. Nailor Industries Inc.
 5. Ruskin Company.
- B. Dynamic fire dampers with curtain style blades, and labeled according to UL 555, maximum velocity 2000 fpm, maximum static pressure 4 inches w.g.
- C. Fire Rating:

1. 1-1/2 hours for 2 hour rated walls.
- D. Frame: Type B or Type C Curtain type with blades outside airstream; fabricated with roll-formed, galvanized steel in gages required by manufacturer's UL listing; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 1. Thickness: Equal to or thicker than the duct connected to it, and of length to suit application.
 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- H. Fusible Links: Replaceable, 165 deg F rated.

2.06 FIRE DAMPERS (MULTIPLE BLADE TYPE)

- A. Manufacturers:
 1. Greenheck.
 2. NCA Manufacturing, Inc.
 3. Nailor Industries Inc.
 4. Ruskin Company.
- B. Dynamic fire dampers with multiple blades, and labeled according to UL 555, maximum velocity of 2000 fpm, maximum static pressure 4 inches w.g.
- C. Fire Rating:
 1. 1-1/2 hours for 2 hour rated walls.
 2. 3 hours for 4 hour rated walls.
- D. Frame: Fabricated with roll-formed, galvanized steel in gages required by manufacturer's UL listing; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 1. Thickness: Equal to or thicker than the duct connected to it, and of length to suit application.
 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Parallel operation, single-piece airfoil type construction with 0.078 inch equivalent thickness, or 0.064 inch thick, roll-formed, triple v-groove.
- H. Axles: 1/2 inch plated steel hex.
- I. Bearings: Stainless steel, or oil-impregnated bronze sleeve type, pressed into frame.
- J. Linkage: Concealed in frame.
- K. Fusible Links: Replaceable, 165 deg F rated.

2.07 SMOKE DAMPERS

- A. Manufacturers:
 1. Air Balance, Inc.
 2. Greenheck.
 3. Nailor Industries Inc.
 4. NCA Manufacturing, Inc.
 5. Ruskin Company.

- B. General Description: Smoke dampers with airfoil blades, labeled according to UL 555S, with minimum Class II leakage rating.
- C. Frame and Blades: 16 gage, galvanized sheet steel.
- D. Mounting Sleeve: Factory-installed, galvanized sheet steel.
 - 1. Thickness: Equal to or thicker than the duct connected to it, and of length to suit application.
- E. Rated pressure and velocity to exceed design airflow conditions.
- F. Damper Actuators: Electric modulating or two-position action as required.
 - 1. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 2. Size for torque required for damper seal at load conditions.
 - 3. Overload Protection: Microprocessor or an electronic based motor controller providing burnout protection if stalled before full rotation is reached. The actuator shall be electronically cut off at full open to eliminate noise generation with the holding noise level to be inaudible.
 - 4. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 - 5. Power Requirements (Two-Position Spring Return): 24 or 120 V ac.
 - 6. Power Requirements (Proportional): Maximum (running) 12 VA at 24-V ac or 8 W at 24-V dc. Maximum (holding) 5VA at 24-V ac or 3 W at 24-V dc holding.
 - 7. Proportional Actuators (24V ac/dc): Control signal shall be 0-10vdc, 2-10vdc or 4-20mA as required to operate with associated controller. Include position feedback signal for 0-10vdc, 2-10vdc or 4-20mA as required to be monitored by associated controller.
 - 8. Actuator timing shall meet 15 sec.
 - 9. Temperature Rating: Actuator shall have a UL555S listing by the damper manufacturer
- G. Damper blade position end switches: Factory installed damper position switch package for both full open and full closed indication (equivalent to Ruskin SP100 switch package).
- H. Test Switch: Damper mounted momentary "test" push-button mounted 2-position "open/closed" keyed switch rated for 24V or 120V as required to allow testing and/or maintenance of motorized dampers.
 - 1. Include damper mounted "open" and "closed" indication lights on switch plate for connection to factory installed damper blade position end switches.

2.08 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:
 - 1. Air Balance, Inc.
 - 2. Greenheck.
 - 3. Nailor Industries Inc.
 - 4. NCA Manufacturing, Inc.
 - 5. Ruskin Company.
- B. General Description: Combination fire and smoke dampers shall be labeled according to UL 555 and UL 555S. Leakage shall not exceed 10 cfm per square foot at 1 inch WG differential pressure (Leakage Class II).
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating:
 - 1. 1-1/2 hours for 2 hour rated walls.
- E. Frame and Blades: 0.064-inch- thick, galvanized sheet steel.
- F. Mounting Sleeve: Factory-installed, galvanized sheet steel.
 - 1. Thickness: Equal to or thicker than the duct connected to it, and of length to suit application.

- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Damper Actuators: Electric modulating or two-position action as required.
 - 1. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 2. Size for torque required for damper seal at load conditions.
 - 3. Overload Protection: Microprocessor or an electronic based motor controller providing burnout protection if stalled before full rotation is reached. The actuator shall be electronically cut off at full open to eliminate noise generation with the holding noise level to be inaudible.
 - 4. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 - 5. Power Requirements (Two-Position Spring Return): 24 or 120 V ac.
 - 6. Power Requirements (Proportional): Maximum (running) 12 VA at 24-V ac or 8 W at 24-V dc. Maximum (holding) 5VA at 24-V ac or 3 W at 24-V dc holding.
 - 7. Proportional Actuators (24V ac/dc): Control signal shall be 0-10vdc, 2-10vdc or 4-20mA as required to operate with associated controller. Include position feedback signal for 0-10vdc, 2-10vdc or 4-20mA as required to be monitored by associated controller.
 - 8. Actuator timing shall meet 15 sec.
 - 9. Temperature Rating: Actuator shall have a UL555S listing by the damper manufacturer for 250 deg F.
- I. Manual Heat Responsive Fuse Link with Reset and Damper Blade Position End Switches: Factory installed manual heat responsive fuse link with reset switch / damper position switch package for both full open and full closed indication (equivalent to Ruskin TS150 switch package).
- J. Test Switch: Damper mounted momentary "test" push-button mounted 2-position "open/closed" keyed switch rated for 24V or 120V as required to allow testing and/or maintenance of motorized dampers.
 - 1. Include damper mounted "open" and "closed" indication lights on switch plate for connection to factory installed damper blade position end switches.

2.09 DUCT SILENCERS (FIBERGLASS FILL)

- A. Manufacturers:
 - 1. Industrial Acoustics Co. Inc.
 - 2. Price Industries.
 - 3. Ruskin Company.
 - 4. VAW Systems Ltd.
 - 5. Vibro-Acoustics.
- B. General Requirements:
 - 1. Factory fabricated.
 - 2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
- C. Rectangular Units: Unless otherwise scheduled on the Drawings, fabricate casings with a minimum of 20 gage, solid galvanized sheet metal for outer casing and 22 gage, ASTM A 653/A 653M, G90, perforated galvanized sheet metal for inner casing.
- D. Round Units: Unless otherwise scheduled on the Drawings:
 - 1. Outer Casings:
 - a. ASTM A 653/A 653M, G90, galvanized sheet steel.
 - b. Up to 8 Inches in Diameter: 24 gage.
 - c. 9 through 22 Inches in Diameter: 22 gage.
 - d. 24 through 36 Inches in Diameter: 20 gage.
 - e. 38 through 50 Inches in Diameter: 18 gage.

- f. 52 through 60 Inches in Diameter: 16 gage.
 - g. Casings fabricated of spiral lock-seam duct may be one gage thinner than that indicated.
 - 2. Interior Casing, Partitions, and Baffles:
 - a. ASTM A 653/A 653M, G90, galvanized sheet steel.
 - b. At least 24 gage thick and designed for minimum aerodynamic losses.
- E. Sheet Metal Perforations: 1/8-inch diameter for inner casing and baffle sheet metal.
- F. Fill Material: Inert and vermin-proof fibrous glass material, packed under not less than 5 percent compression.
 - 1. Erosion Barrier: Mylar film with 1/4-inch standoff.
 - a. Return fan inlet and outlet silencer fill shall not be encapsulated in Mylar.
- G. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations.
 - 1. Do not use nuts, bolts, or sheet metal screws for unit assemblies.
 - 2. Lock form and seal or continuously weld joints.
 - 3. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
 - 4. Reinforcement: Cross or trapeze angles for rigid suspension.
- H. Source Quality Control:
 - 1. Acoustic Performance: Test according to ASTM E 477.
 - a. Tests performed in NVLAP accredited laboratory.
 - b. Include accreditation certificate with submittals.
 - c. Submittals from non-NVLAP accredited facilities will not be accepted.
 - 2. Record acoustic ratings, including dynamic insertion loss and self-noise power levels with an airflow of at least 2000-fpm face velocity.
 - 3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

2.10 TURNING VANES

- A. Manufactured Turning Vanes:
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
 - 2. Double-vane or airfoil-shaped, curved blades of galvanized sheet steel set into vane runners suitable for duct mounting.
 - 3. Generated sound power level shall not exceed 54 decibels in octave band 4 at 2000 fpm in a 24-inch by 24-inch duct.
 - 4. Manufacturers:
 - a. Aero/Dyne Company; H-E-P Turning Vanes.
 - b. Ductmate Industries, Inc.
 - c. Duro Dyne Corp.
 - d. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Acoustic Turning Vanes:
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
 - 2. Double-vane curved blades of galvanized sheet steel with perforated faces and fibrous-glass fill set into vane runners suitable for duct mounting.
 - 3. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

2.11 DUCT-MOUNTING ACCESS DOORS

- A. General Description: Fabricate doors airtight and suitable for duct pressure class. Doors may be field fabricated in accordance with SMACNA Standards, or commercially produced.

- B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.
 - 1. Manufacturers:
 - a. Air Balance, Inc.
 - b. Greenheck.
 - c. Nailor Industries Inc.
 - d. Ruskin Company.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Provide number of hinges and locks as follows:
 - a. Less Than 12 Inches Square: Secure with two sash locks.
 - b. Up to 18 Inches Square: Two hinges and two compression locks.
 - c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
 - d. Sizes 24 by 48 Inches and Larger: One additional hinge.
- C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.
 - 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Flexmaster U.S.A., Inc.
 - 2. Frame: Galvanized sheet steel, with spin-in notched frame.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.12 FLEXIBLE CONNECTORS

- A. Manufacturers:
 - 1. ADSCO Manufacturing LLC.
 - 2. Duro Dyne Corp.
 - 3. Senior Flexonics Pathway.
 - 4. Ventfabrics, Inc.
- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd..
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.

2.13 FLEXIBLE DUCTS, LOW AND MEDIUM PRESSURE

- A. Manufacturers:
 - 1. Flexmaster Type 8M, UL 181, Class 1.
 - 2. Automation Industries Thermaflex.
 - 3. Hart & Cooley.
- B. Flexible Ducts: Interlocking spiral of galvanized steel or aluminum construction or fabric supported by helically wound spring steel wire or flat steel bands; rated to 6 inches WG positive and 4 inches WG negative for low and medium pressure ducts.

- C. Insulated Flexible Ducts: Flexible duct wrapped with flexible glass fiber insulation, enclosed by a fire retardant polyethylene vapor barrier jacket; maximum 0.23 K value at 75 deg F.
- D. Acoustical performance tested in accordance with the Air Diffusion Council's *Flexible Air Duct Test Code FD 72-R1, Section 3.0, Sound Properties* shall be as follows:

The insertion loss (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be minimum:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	8	32	38	35	39	25
8" diameter	13	32	36	35	36	21
12" diameter	15	29	28	33	26	14

The radiated noise reduction (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be minimum:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	6	8	7	8	9	13
8" diameter	9	6	6	7	8	10
12" diameter	9	7	6	6	8	11

The self generated sound power levels (LW) dB are 10-12 Watt of a 10 foot length of straight duct for an empty sheet metal duct when tested in accordance with ASTM E477, at a velocity of 1000 feet per minute, shall not exceed:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	42	31	23	18	17	21
8" diameter	41	34	27	19	18	21
12" diameter	53	44	36	27	21	22

- E. Flexible Duct Fittings: Galvanized steel, twist-in design with damper. Size as indicated.
- F. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches to suit duct size.

2.14 FLEXIBLE DUCT ELBOW SUPPORTS

- A. Manufacturer:
 1. Automation Industries Thermaflex; FlexFlow Elbow.
 2. Smart Air & Energy Solutions; SMART Flow Elbow.
- B. Elbow supports shall be constructed of durable composite material and be fully adjustable to support flexible duct diameters 6 inches through 16 inches.
- C. Elbow supports shall be UL listed for use in return air plenum spaces.

2.15 DUCT ACCESSORY HARDWARE

- A. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.16 FINISHES

- A. Chemical Resistant Coating: P-403 manufactured by Heresite Chemical Company.

PART 3 EXECUTION

3.01 APPLICATION AND INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

- B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts and PVC coated ducts; and aluminum accessories in aluminum ducts.
- C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers in ducts with liner in a manner that avoids damage to and erosion of duct liner.
- E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.
- F. Install fire and smoke dampers according to UL listing.
- G. Install duct silencers rigidly to ducts.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. Control devices requiring inspection.
 - 8. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Install duct-mounting, rectangular access doors with long dimension at right angles to direction of airflow and of largest standard size which can be accommodated in duct. Maximum size: 21 by 14 inches.
- K. Install pressure relief doors vertically and level in accordance with manufacturer's instructions, between the fan and first operable damper.
- L. Label access doors according to Division 20 Section "Mechanical Identification."
- M. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
- N. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- O. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- P. Connect diffusers or light troffer boots to low pressure ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- Q. Connect flexible ducts to metal ducts with draw bands.
- R. Install flexible duct elbow supports at each diffuser, grille, or register, and elsewhere as indicated.
- S. Install turning vanes in rectangular duct elbows in excess of 45 degrees, and where indicated:
 - 1. Use manufactured double-vane turning vanes unless otherwise specified.
 - 2. Seat outboard-most vane in heel of duct elbow.

3. Provide vanes for all runner punchings, practice of eliminating every other vane is prohibited.
4. Use single-vane turning vanes in low pressure square elbows.

3.02 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation.
 5. Operate remote damper operators to verify full range of movement of operator and damper.

3.03 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION 23 33 00

SECTION 23 34 23
POWER VENTILATORS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 PERFORMANCE REQUIREMENTS	1
1.03 SUBMITTALS	1
1.04 QUALITY ASSURANCE	2
1.05 DELIVERY, STORAGE, AND HANDLING	2
1.06 COORDINATION	2
1.07 EXTRA MATERIALS	2
PART 2 PRODUCTS	2
2.01 UPBLAST CENTRIFUGAL ROOF VENTILATORS	2
2.02 ROOF CURBS AND ACCESSORIES	3
2.03 MOTORS	3
2.04 SOURCE QUALITY CONTROL	3
PART 3 EXECUTION	3
3.01 INSTALLATION	3
3.02 CONNECTIONS	4
3.03 FIELD QUALITY CONTROL	4
3.04 ADJUSTING	4

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."
 - 2. Division 20 Section "Motors."
 - 3. Division 23 Section "Common Work Results for HVAC" for common mechanical drive requirements for fans and air moving equipment.

1.02 PERFORMANCE REQUIREMENTS

- A. Classify according to AMCA 99.

1.03 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Roof curbs.
 - 7. Fan speed controllers.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
 - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

- C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Roof framing and support members relative to duct penetrations.
 - 2. Ceiling suspension assembly members.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For power ventilators to include in operation and maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.06 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- C. Coordinate delivery and placement of roof curbs, and equipment supports. Installation of roof curbs, equipment supports, and roof penetrations is specified in Division 07 Section "Roof Accessories."

1.07 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: One set for each belt-drive unit.

PART 2 PRODUCTS

2.01 UPBLAST CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acme Engineering & Mfg. Corp.
 - 2. Aerovent; a Twin City Fan Company.
 - 3. Greenheck; CUBE Series.
 - 4. Loren Cook Company.
 - 5. Moffitt Corporation, Inc.
 - 6. PennBarry; a unit of Tomkins PLC; Fumex.
- B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

- C. Housing: Spun-aluminum construction with square, one-piece, aluminum base with venturi inlet cone. Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
- D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
 - 1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 3. Sheaves: Cast-iron, adjustable-pitch motor sheave.
 - 4. Fan and motor isolated from exhaust airstream.
 - 5. Refer to Division 23 Section "Common Work Results for HVAC" for additional requirements.
- F. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 - 3. Hinged base to access motorized isolation damper.
 - 4. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
- G. Provide prefabricated roof curbs for each fan.
- H. Capacities and Characteristics: Refer to schedule(s) on Drawings.

2.02 ROOF CURBS AND ACCESSORIES

- A. Construction: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch chemically treated wood nailer. Size as required to suit roof opening and fan base.
 - 1. Manufacturers: Roof curbs shall be provided by the fan manufacturer, or one of the following:
 - a. Creative Metals.
 - b. Pate.
 - c. Roof Products & Systems.
 - d. ThyCurb.
 - e. Any of the approved roof mounted exhaust fan manufacturers.
 - 2. Configuration: Self-flashing without a cant strip, with mounting flange.
 - 3. Height: Curb shall extend a minimum 12 inches above top surface of roof insulation.
 - 4. Metal Liner: Galvanized steel.

2.03 MOTORS

- A. Comply with requirements in Division 20 Section "Motors."

2.04 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.
- C. Install units with clearances for service and maintenance.

- D. Label units according to requirements specified in Division 20 Section "Mechanical Identification."

3.02 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."
- C. Connect wiring according to Division 26 Section "Conductors and Cables."

3.03 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
1. Verify that shipping, blocking, and bracing are removed.
 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 3. Verify that cleaning and adjusting are complete.
 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 5. Adjust belt tension.
 6. Adjust damper linkages for proper damper operation.
 7. Verify lubrication for bearings and other moving parts.
 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 10. Shut unit down and reconnect automatic temperature-control operators.
 11. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor sheaves as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 23 34 23

SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUBMITTALS	1
1.03 QUALITY ASSURANCE	2
1.04 COORDINATION	2
PART 2 PRODUCTS	2
2.01 MANUFACTURERS	2
2.02 SINGLE-DUCT AIR TERMINAL UNITS	2
2.03 HANGERS AND SUPPORTS	2
2.04 SOURCE QUALITY CONTROL	3
PART 3 EXECUTION	3
3.01 INSTALLATION	3
3.02 HANGER AND SUPPORT INSTALLATION	3
3.03 CONNECTIONS	3
3.04 FIELD QUALITY CONTROL	3
3.05 STARTUP SERVICE	4
3.06 DEMONSTRATION	4

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 20 Section "Mechanical General Requirements."
 2. Division 23 Section "Metal Ducts."

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.
 1. Liners and adhesives.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 1. Ceiling suspension assembly members.
 2. Method of attaching hangers to building structure.
 3. Size and location of initial access modules for acoustical tile.
 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Operation and Maintenance Data: For air terminal units to include in operation and maintenance manuals. Include the following:
 1. Instructions for resetting minimum and maximum air volumes.
 2. Instructions for adjusting software set points.

1.03 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.04 COORDINATION

- A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers:
 - 1. Anemostat; a Mestek Company.
 - 2. Krueger; Tomkins PLC.
 - 3. Nailor Industries of Texas Inc.
 - 4. Price Industries.
 - 5. Titus; Tomkins PLC.
 - 6. Tuttle & Bailey; Tomkins PLC.
- B. Configuration: Variable and constant volume, medium pressure terminal units with casing, 100 percent tight shutoff volume regulator, velocity sensor, and sound attenuating thermal insulation.
- C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
 - 1. Maximum Damper Leakage: AHRI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
- D. Velocity Sensor: Multipoint averaging array. Sensor located in air inlet.
- E. Attenuator Section: 0.034-inch mill galvanized steel or 0.032-inch aluminum sheet metal.
 - 1. Lining: 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil.
- F. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig; and factory installed.
- G. DDC Controls: Single-package unitary controller and actuator specified in Division 23 Section "Temperature Controls."

2.03 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Steel Cables: Galvanized steel complying with ASTM A 603.
- C. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- D. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

- E. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.04 SOURCE QUALITY CONTROL

- A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and AHRI certification seal.
- B. Verification of Performance: Rate air terminal units according to AHRI 880.
- C. Acoustical Applications and Sound Evaluation: Based on AHRI Standard 885-98, "Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets."

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts or structural-steel fasteners appropriate for construction materials to which hangers are being attached. Refer to Division 20 Section "Hangers and Supports" for additional information.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to air terminal units to allow service and maintenance.
- C. Hot Water Piping: Unless otherwise indicated:
 - 1. Install union and isolation valve on supply-water connection.
 - 2. Install union and calibrated balancing valve or PICCV as indicated on the Drawings on return-water connection.
 - 3. Hydronic specialties are specified in Division 23 Section "Hydronic Piping."
- D. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."
- E. Connect wiring according to Division 26 Section "Conductors and Cables."

3.04 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Leak Test: After installation, fill water coils 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.
- B. Remove and replace malfunctioning units and retest as specified above.

3.05 STARTUP SERVICE

- A. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 - 2. Verify that controls and control enclosure are accessible.
 - 3. Verify that control connections are complete.
 - 4. Verify that nameplate and identification tag are visible.
 - 5. Verify that controls respond to inputs as specified.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 23 36 00

SECTION 23 37 13 DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUBMITTALS	1
PART 2 PRODUCTS	1
2.01 AIR DIFFUSION DEVICES	1
2.02 SOURCE QUALITY CONTROL	2
PART 3 EXECUTION	2
3.01 EXAMINATION	2
3.02 INSTALLATION	2
3.03 ADJUSTING	2

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
 - 2. Division 20 Section "Mechanical General Requirements."
 - 3. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.02 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Duct access panels.

PART 2 PRODUCTS

2.01 AIR DIFFUSION DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Krueger; Tomkins PLC.
 - 2. Nailor Industries of Texas Inc.
 - 3. Price Industries.
 - 4. Titus; Tomkins PLC.
- B. Terminal air diffusion devices have been chosen in terms of specific air distribution requirements, spacing, and sound characteristics.
- C. Provide plaster frames for units installed in plaster ceilings.
- D. Provide gaskets for supply terminal air devices mounted in finished surfaces.

- E. Finish:
 - 1. Air Diffusion Device Face and Visible Trim: Standard off white baked enamel finish unless noted otherwise.
 - 2. Air Diffusion Device Interior Surfaces, Including Blank-Offs: Black matte finish.
- F. Air pattern adjustments shall be made from the face of the device.
- G. Refer to drawings and schedules for quantities, types, and finishes.
- H. Coordinate frame types with Architectural Reflected Ceiling Plan.

2.02 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."
- B. Acoustical Applications and Sound Evaluation: Based on ARI Standard 885-98, "Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets."

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Wall-Mounted Supply Registers: Install 6 inches below finished ceiling unless otherwise indicated.
- D. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 23 81 20
UNITARY ROOFTOP AIR CONDITIONERS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	1
1.04 SUBMITTALS	1
1.05 QUALITY ASSURANCE	1
1.06 COORDINATION	2
1.07 EXTRA MATERIALS	2
PART 2 PRODUCTS	2
2.01 MANUFACTURERS	2
2.02 UNITARY ROOFTOP AIR CONDITIONERS 6 TONS AND SMALLER	2
2.03 MOTORS	4
PART 3 EXECUTION	4
3.01 INSTALLATION	4
3.02 CONNECTIONS	4
3.03 FIELD QUALITY CONTROL	5
3.04 STARTUP SERVICE	5
3.05 ADJUSTING	6
3.06 DEMONSTRATION	6

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."
 - 2. Division 20 Section "Basic Mechanical Materials and Methods."
 - 3. Division 23 Section "Common Work Results for HVAC" for common mechanical drive requirements for fans and air handling equipment.

1.02 SUMMARY

- A. This Section includes outdoor-mounted unitary air conditioning units smaller than 20 tons.
- B. Products supplied but not installed under this Section:
 - 1. Roof curbs and equipment rails.

1.03 DEFINITIONS

- A. DDC: Direct-digital controls.
- B. BAS: Building Automation System.

1.04 SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For rooftop air conditioners to include in operation and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. AHRI Compliance:

1. Comply with AHRI 210/240 and AHRI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with AHRI 270 for testing and rating sound performance for RTUs.
- B. ASHRAE Compliance:
 1. Comply with ASHRAE 15 for refrigeration system safety.
 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
- C. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
- D. 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.

1.06 COORDINATION

- A. Coordinate size and locations of roof curbs, equipment supports, and roof penetrations. Framing, flashing, and attachment to roof structure are specified under Division 07.

1.07 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fan Belts: One set for each belt-drive fan.
 2. Filters: One set of filters for each unit.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 UNITARY ROOFTOP AIR CONDITIONERS 6 TONS AND SMALLER

- A. Manufacturers:
 1. Daikin.
 2. Johnson Controls Incorporated/YORK; Series 10 – (basis of design).
 3. Trane Company; a Division of Ingersoll Rand.
- B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, condenser coil, direct expansion cooling coil, supply-air fan, variable speed drives, condenser coil fan, refrigeration controls, filters, dampers, and temperature controls or unit interface specified for unit controls.
- C. Maximum Temperature Distribution Across Supply Air Outlet:
 1. 10 deg F Heating.
 2. 5 deg F Cooling.
- D. Casing: Galvanized-steel single-wall construction with enamel paint finish, hinged access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch- thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.
- E. Condensate Drain Pans: Formed sections of stainless-steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.1.
 1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
 2. Drain Connections: Threaded nipple.
- F. Supply-Air Fan: Forward curved, centrifugal, belt driven by single-speed motor.
- G. Condenser Coil Fan: Propeller type, directly driven by motor.

- H. Direct Expansion Cooling Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
- I. Compressor: Hermetic reciprocating or scroll compressor with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief, and crankcase heater.
- J. Refrigeration System:
 - 1. Compressor.
 - 2. Condenser coil and fan.
 - 3. Direct expansion cooling coil and supply-air fan.
 - 4. Check valves.
 - 5. Expansion valve with replaceable thermostatic element.
 - 6. Refrigerant dryer.
 - 7. High-pressure switch.
 - 8. Low-pressure switch.
 - 9. Hot gas bypass.
 - 10. Thermostat for coil freeze-up protection during low-ambient temperature operation or loss of air.
 - 11. Low-ambient switch.
 - 12. Brass service valves installed in discharge and liquid lines.
 - 13. Refrigerant: R-407C or R-410A.
 - 14. Compressor Motor Overload Protection: Manual reset.
 - 15. Anti-recycling Timing Device: Prevents compressor restart for five minutes after shutdown.
 - 16. Oil-Pressure Switch: Designed to shut down compressors on low oil pressure.
- K. Filters: 2-inch- thick, fiberglass, pleated, throwaway filters in filter rack.
- L. Heat Exchanger: Aluminized-steel or stainless-steel construction for natural-gas-fired burners. Units utilizing 50 percent or greater outside air must be stainless steel construction. Include the following controls:
 - 1. Redundant single or dual gas valve with manual shutoff.
 - 2. Direct-spark pilot ignition.
 - 3. Electronic flame sensor.
 - 4. Induced-draft blower.
 - 5. Flame rollout switch.
- M. Economizer: Return- and outside-air dampers with neoprene seals, bird screen, and hood.
 - 1. Damper Motor: Fully modulating spring return with adjustable minimum position.
 - 2. Control: Electronic-control system uses return-air and outside-air temperature to adjust mixing dampers.
 - 3. Relief Damper: Gravity actuated with bird screen and hood.
- N. Power Connection: Provide for single connection of power to unit with factory mounted and wired unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.
- O. Unit Controls: Solid-state control board and components contain at least the following features:
 - 1. Supply-air fan control relay.
 - 2. Default control to ensure proper operation after power interruption.
 - 3. Field-adjustable control parameters.
 - 4. Economizer control.
 - 5. Gas valve delay between first- and second-stage firing.
 - 6. Night setback mode (outside air damper lockout relay).
 - 7. Low-refrigerant pressure control.
 - 8. Control interface for BAS communication link.
- P. Conventional Thermostat Interface (BAS control or thermostat provided by others): For heating control, cooling control, occupied/unoccupied mode scheduling, and miscellaneous available

status and alarm monitoring. Control interface details in accordance with temperature control system details indicated on the Drawings and specified in Division 23 Section "Temperature Controls."

Q. Accessories:

1. Cold-Weather Kit: Electric heater maintains temperature in gas burner compartment.
2. Service Outlets: 115-V, ground-fault, circuit-interrupter type, field wired such that outlet remains energized even if the unit main disconnect is open.
3. Dirty-filter switch.
4. Hail guards of steel, painted to match casing.

R. Roof Curb: Steel with corrosion-protection coating, gasketing, and factory-installed wood nailer; complying with NRCA standards. Top of curb shall be level and extend a minimum of 18 inches above top of roof insulation. Provide additional height if required to accommodate duct transitions.

S. Curb Adaptor: Insulated steel with corrosion-proof coating, Provide where required for fitting new units on existing roof curbs.

2.03 MOTORS

A. Comply with requirements in Division 20 Section "Motors."

PART 3 EXECUTION

3.01 INSTALLATION

- A. Hoist, transport, and rig air conditioning units or their shipping sections into position following procedures recommended by the manufacturer.
- B. Install units level and plumb, maintaining manufacturer's recommended clearances. Install according to AHRI Guideline B.
- C. Deliver roof curbs and equipment supports to site for installation under Division 07. Install rooftop air conditioners on equipment curbs and supports specified and as scheduled. Secure units to curb support with anchor bolts.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 23 Sections.
- B. Install piping adjacent to machine to allow service and maintenance.
 1. Gas Piping: Comply with applicable requirements in Division 23 Section "Fuel Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 1. Install ducts to termination in roof curb.
 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 3. Connect supply ducts to rooftop unit with flexible duct connectors specified in Division 23 Section "Duct Accessories."
 4. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- thick, acoustic duct liner.
- D. Electrical System Connections: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.
- E. Ground equipment according to Division 26 Section "Grounding and Bonding."
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.
- B. Perform the following field quality-control tests and inspections and prepare test reports:
 - 1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Repair malfunctioning units and retest as specified above; or remove malfunctioning units, replace with new units and retest as specified.

3.04 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Inspect for visible damage to unit casing.
 - 2. Inspect for visible damage to furnace combustion chamber.
 - 3. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
 - 4. Inspect internal insulation.
 - 5. Verify that labels are clearly visible.
 - 6. Verify that clearances have been provided for servicing.
 - 7. Verify that controls are connected and operable.
 - 8. Verify that filters are installed.
 - 9. Clean outside coil and inspect for construction debris.
 - 10. Clean furnace flue and inspect for construction debris.
 - 11. Connect and purge gas line.
 - 12. Adjust vibration isolators.
 - 13. Inspect operation of barometric dampers.
 - 14. Lubricate bearings on fan.
 - 15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 16. Adjust fan belts to proper alignment and tension.
 - 17. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system in summer only.
 - b. Complete startup sheets and attach copy with Contractor's startup report.
 - 18. Inspect and record performance of interlocks and protective devices; verify sequences.
 - 19. Operate unit for an initial period as recommended or required by manufacturer.
 - 20. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency. Adjust pilot to stable flame.
 - a. Measure gas pressure on manifold.
 - b. Measure combustion-air temperature at inlet to combustion chamber.
 - c. Measure flue-gas temperature at furnace discharge.
 - d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
 - 21. Check control interface wiring.
 - 22. Adjust and inspect high-temperature limits.
 - 23. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
 - 24. Start refrigeration system and measure and record the following:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.

- b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outside-air, dry-bulb temperature.
 - d. Outside-air-coil, discharge-air, dry-bulb temperature.
- 25. Inspect and verify operation of controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
- 26. Measure and record the following minimum and maximum airflows.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outside-air intake volume.
- 27. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through outside coil or from outside coil to outside-air intake.
- 28. Record all final adjustment and control settings.
- 29. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

3.05 ADJUSTING

- A. Adjust initial temperature set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners.

END OF SECTION 23 81 20

SECTION 26 00 10 ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 REFERENCES	1
1.04 QUALITY ASSURANCE	2
1.05 CODES, PERMITS AND FEES	2
1.06 DRAWINGS	3
1.07 MATERIAL AND EQUIPMENT MANUFACTURERS	3
1.08 INSPECTION OF SITE	3
1.09 ITEMS REQUIRING PRIOR APPROVAL	3
1.10 SHOP DRAWINGS/SUBMITTALS	4
1.11 COORDINATION DRAWINGS	4
1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS	4
1.13 RECORD DRAWINGS	5
1.14 INSTRUCTION OF OWNER PERSONNEL	5
1.15 WARRANTY	5
1.16 USE OF EQUIPMENT	5
1.17 COORDINATION	5
PART 2 PRODUCTS (NOT APPLICABLE)	6
PART 3 EXECUTION	6
3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION	6
3.02 DEMOLITION WORK	6
3.03 INSTALLATION OF EQUIPMENT	7
3.04 WORK IN EXISTING BUILDINGS	7
3.05 TEMPORARY SERVICES	7
3.06 DISPOSAL	7
3.07 CHASES AND RECESSES	8
3.08 CUTTING, PATCHING AND DAMAGE TO OTHER WORK	8
3.09 EXCAVATION AND BACKFILLING	8
3.10 EQUIPMENT CONNECTIONS	8
3.11 CLEANING	8
3.12 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS	8
3.13 EXTRA WORK	9
3.14 DRAWINGS AND MEASUREMENTS	9

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 SUMMARY

- A. This Section includes electrical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 1 Specification Sections.

1.03 REFERENCES

- A. All materials shall be new. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
 1. ANSI - American National Standards Institute; www.ansi.org.

2. ASTM - ASTM International; www.astm.org.
3. CSI - Construction Specifications Institute (The); www.csiresources.org.
4. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
5. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
6. NEC - National Electrical Code
7. NECA - National Electrical Contractors Association; www.necanet.org.
- a. NECA 1-2000, "Practices for Good Workmanship in Electrical Contracting (ANSI)."
8. NEMA - National Electrical Manufacturers Association; www.nema.org.
9. NETA - InterNational Electrical Testing Association; www.netaworld.org.
10. UL - Underwriters Laboratories Inc.; www.ul.com.

1.04 QUALITY ASSURANCE

- A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the electrical systems as specified in the Division 26 Sections and as indicated on Drawings.
 1. Contract Documents are complimentary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bids shall be based on the most expensive combination of quality and quantity of the work indicated.
 2. The Contractor understands that the work herein described shall be complete in every detail.
- B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of NFPA, NECA, and UL, unless otherwise indicated.
 1. Notify the Architect/Engineer before submitting a proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations. After entering into Contract, make all changes required to conform to above ordinances, rules and regulations without additional expense to the Owner.
- C. Source Limitations: All equipment of the same or similar systems shall be by the same manufacturer.
- D. Tests and Inspections: Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.
- E. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the trades involved.
- F. Sequence and Schedule: Work so as to avoid interference with the work of other trades. Be responsible for removing and relocating any work which in the opinion of the Owner's Representatives causes interference.

1.05 CODES, PERMITS AND FEES

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the Contractor. All work shall conform to all applicable codes, rules and regulations.
- B. Rules of local utility companies shall be complied with. Coordinate with the utility company supplying service to the installation and determine all devices including, but not limited to, all current and potential transformers, meter boxes, C.T. cabinets and meters which will be required and include the cost of all such items and all utilities costs in proposal.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed Drawings or diagrams which may be required by the governing authorities. Where the Drawings and/or Specifications indicate materials or construction in excess of code requirements, the Drawings and/or Specifications shall govern.

1.06 DRAWINGS

- A. The Drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the Drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.
- C. Deviations from the Drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The architectural and structural Drawings take precedence in all matters pertaining to the building structure, mechanical Drawings in all matters pertaining to mechanical trades and electrical Drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.
- E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

1.07 MATERIAL AND EQUIPMENT MANUFACTURERS

- A. All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of electrical equipment and shall be of the manufacturer's latest design.
- B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, electrical work, and building alterations shall be included in the original Bid. Similar equipment shall be by one manufacturer.
- C. Where existing equipment is modified to include new switches, circuit breakers, metering or other components, the new components shall be by the original equipment manufacturer and shall be listed for installation in the existing equipment. Where original equipment manufacturer components are not available, third party aftermarket components shall be listed for the application and submitted to the engineer for approval. Reconditioned or salvaged components shall not be used unless specifically indicated on the drawings.

1.08 INSPECTION OF SITE

- A. Visit the site, examine and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.

1.09 ITEMS REQUIRING PRIOR APPROVAL

- A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 1 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings

at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.

1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.
 2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, electrical, replacement of other components, and building alterations shall be included in the original bid.
- B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid.

1.10 SHOP DRAWINGS/SUBMITTALS

- A. Submit project-specific submittals for review in compliance with Division 1.
- B. All shop Drawings shall be submitted in groupings of similar and/or related items (lighting fixtures, switchgear, etc.). Incomplete submittal groupings will be returned unchecked.
- C. If deviations (not substitutions) from Contract Documents are deemed necessary by the Contractor, details of such deviations, including changes in related portions of the project and the reasons therefore, shall be submitted with the submittal for approval.
- D. Submit for approval shop drawings for all electrical systems or equipment but not limited to the items listed below. Where items are referred to by symbolic designation on the Drawings and Specifications, all submittals shall bear the same designation (light fixtures). Refer to other sections of the electrical Specifications for additional requirements.
 1. Wiring Devices
 2. Lighting Control Devices
 3. Enclosed Switches and Circuit Breakers
 4. Enclosed Controllers
 5. Fuses
 6. Interior Lighting
 7. Communications Horizontal Cabling
 8. Fire Alarm

1.11 COORDINATION DRAWINGS

- A. Submit project specific coordination drawings for review in compliance with Division 1 Specification Sections.

1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS

- A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 01 Specification Sections.
- B. Provide complete operation and maintenance instructional manuals covering all electrical equipment herein specified, together with parts list. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Four (4) copies of all literature shall be furnished for Owner and shall be bound in ring binder form. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.
- C. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:
 1. Routine maintenance procedures.
 2. Trouble-shooting procedures.
 3. Contractor's telephone numbers for warranty repair service.
 4. Submittals.
 5. Recommended spare parts list.
 6. Names and telephone numbers of major material suppliers and subcontractors.

7. System schematic drawings on 8-1/2" x 11" sheets.

1.13 RECORD DRAWINGS

- A. Submit record drawings in compliance with Division 01.
- B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media which have been neatly marked to represent as-built conditions for all new electrical work. Modifications to original drawings shall be clearly marked with a contrasting color so the marks are readily apparent.
- C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request during the course of construction.

1.14 INSTRUCTION OF OWNER PERSONNEL

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of electrical equipment and systems at agreed upon times. A minimum of 8 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.
- B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. In addition to individual equipment training provide overview of each electrical system. Utilize the as-built documents for this overview.
- D. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction, or as requested by Owner.

1.15 WARRANTY

- A. Warranty: Comply with the requirements in Division 01 Specification Sections. Contractor shall warranty that the electrical installation is free from defects and agrees to replace or repair, to the Owner's satisfaction, any part of this electrical installation which becomes defective within a period of one year (unless specified otherwise in other Division 26 sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.
- B. Contractor shall be responsible for any temporary services including equipment and installation required to maintain operation as a result of any equipment failure or defect during warranty period.
- C. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

1.16 USE OF EQUIPMENT

- A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.
- B. Do not use Owner's lamps for temporary lighting except as allowed and directed by the Owner. Equip lighting fixtures with new lamps when the project is turned over to the Owner.

1.17 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.

4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."
- D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.02 DEMOLITION WORK

- A. All demolition of existing electrical equipment and materials will be done by this Contractor unless otherwise indicated. Include all items such as, but not limited to, electrical equipment, devices, lighting fixtures, conduit, and wiring called out on the Drawings and as necessary whether such items are actually indicated on the Drawings or not in order to accomplish the installation of the specified new work.
- B. In general, demolition work is indicated on the Drawings. However, the Contractor shall visit the job site to determine the full extent and character of this work.
- C. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Items on which the Owner waives ownership shall become the property of the Contractor, who shall remove and legally dispose of same, away from the premises.
- D. Where equipment or fixtures are removed, outlets shall be properly blanked off, and conduits capped. After alterations are done, the entire installation shall present a "finished" look, as approved by the Architect/Engineer. The original function of the present electrical work to be modified shall not be changed unless required by the specific revisions to the system as specified or as indicated.
- E. Reroute signal wires, lighting and power wiring as required to maintain service. Where walls and ceilings are to be removed as shown on the Drawings, the conduit is to be cut off by the Electrical Trades so that the abandoned conduit in these walls and ceilings may be removed with the walls and ceilings by the Architectural Trades. All dead-end conduit runs shall be plugged at the remaining line outlet boxes or at the panels.

- F. Where new walls and/or floors are installed which interfere with existing outlets, devices, etc., the Electrical Trades shall adjust, extend and reconnect such items as required to maintain continuity of same.
- G. All electrical work in altered and unaltered areas shall be run concealed wherever possible. Use of surface raceway or exposed conduits will be permitted only where approved by the Architect/Engineer.
- H. Existing lighting shall be reused where indicated on plans. Reused fixtures shall be detergent cleaned, relamped and reconditioned suitable for satisfactory operation and appearance.

3.03 INSTALLATION OF EQUIPMENT

- A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the Drawings and Specifications, report such conflicts to the Architect/Engineer for resolution.
- B. Device Location:
 - 1. Allow for relocation prior to installation of wiring devices and other control devices, for example, receptacles, switches, fire alarm devices, and access control devices, within a 10-foot radius of indicated location without additional cost.

3.04 WORK IN EXISTING BUILDINGS

- A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once Work is started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.
- B. Adequately protect and preserve all existing and newly installed Work. Promptly repair any damage to same at Contractor's expense.
- C. Consult with the Owner's Representative as to the methods of carrying on the Work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's Representative.
- D. Prior to starting work in any area, obtain approval for doing so from a qualified representative of the Owner who is designated and authorized by the Owner to perform testing and abatement of all hazardous materials including but not limited to, asbestos. The Contractor shall not perform any inspection, testing, containment, removal or other work that is related in any way whatsoever to hazardous materials under the Contract.

3.05 TEMPORARY SERVICES

- A. Provide and remove upon completion of the project, in accordance with the general conditions and as described in Division 01, a complete temporary electrical and telephone service during construction.

3.06 DISPOSAL

- A. Fluorescent Lamps
 - 1. Fluorescent lamps are known to contain mercury and are classified as hazardous material. All fluorescent lamps shall be assumed to contain mercury unless tested and confirmed otherwise with a toxicity characteristic leaching procedure (TCLP).
 - 2. Hazardous materials (fluorescent lamps), shall be sent to a lamp recycling facility. The materials shall be properly packaged with labels that meet the Department of Transportation Regulations and stored in a secure location prior to transportation.
 - 3. The Contractor shall identify the costs of the lamp disposal process including, but not limited to, the lamp packaging, storage, transportation, disposal, and any profile fees.
 - 4. At the completion of the project, provide documentation to verify that the lamps have been properly disposed of in accordance with all local, state and federal guidelines.
- B. Ballasts

1. Lighting ballasts manufactured prior to 1979 have been known to contain polychlorinated biphenyls (PCBs). Unless specifically noted on the ballast as containing "No PCBs," the ballast shall be assumed to contain components with PCB materials.
2. Hazardous materials (ballasts with PCBs), shall be disposed of at a hazardous waste incineration facility, or at a recycling facility in accordance with the Code of Federal Regulations as administered by the EPA in regards to this issue. The ballasts shall be packaged/stored in fifty-five gallon steel drums with labels that meet the Department of Transportation Regulations.
3. The Contractor shall identify the costs of the ballast disposal process including, but not limited to, the packaging, storage, transportation, disposal, and any profile fees.
4. Provide at completion of the project documentation (manifests) to verify that the ballasts have properly been disposed of in accordance with all local, state and federal guidelines.

3.07 CHASES AND RECESSES

- A. Provided by the architectural trades, but the Contractor shall be responsible for their accurate location and size.

3.08 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

- A. Refer to General Conditions for requirements.
- B. All cutting, patching and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

3.09 EXCAVATION AND BACKFILLING

- A. Provide all excavation, trenching, tunneling, dewatering and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.
- B. Where conduit is installed less than 2'6" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical Drawings.
- C. Backfill all excavations with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.
- D. Backfill all excavations inside building, under drives and parking areas with well-tamped granular material. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.
- E. Backfill outside building with granular material to a height 12 inches over top of pipe compacted to 95 percent compaction as specified above. Backfill remainder of excavation with unfrozen, excavated material in such a way to prevent settling.

3.10 EQUIPMENT CONNECTIONS

- A. Make connections to equipment, motors, lighting fixtures, and other items included in the work in accordance with the approved shop Drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. All additional connections not shown on the Drawings, but called out by the equipment manufacturer's shop Drawings shall be provided.

3.11 CLEANING

- A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.
- B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

3.12 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

- A. Equipment and materials shall be protected from theft, injury or damage.

- B. Protect conduit openings with temporary plugs or caps.
- C. Provide adequate storage for all equipment and materials delivered to the job site. Location of the space will be designated by the Owner's representative or Architect/Engineer. Equipment set in place in unprotected areas must be provided with temporary protection.

3.13 EXTRA WORK

- A. For any extra electrical work which may be proposed, this Contractor shall furnish to the General Contractor, an itemized breakdown of the estimated cost of the materials and labor required to complete this work. The Contractor shall proceed only after receiving a written order from the General Contractor establishing the agreed price and describing the work to be done. Prior to any extra work which may be proposed, the Electrical Contractor shall submit unit prices (same prices for increase/decrease of work) for the following items: 1/2", 3/4", 1", 1-1/2" conduit; #12, #10, #8, #6, #2 wire; receptacle, data box, fire alarm combination visual/audible notification appliance, fire alarm visual notification appliance, clock, or other devices which may be required for any proposed extra work.

3.14 DRAWINGS AND MEASUREMENTS

- A. The Drawings are not intended to be scaled for rough-in measurements nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement are the Contractor's responsibility. The Contractor shall check latest Architectural Drawings and locate light switches from same where door swings are different from Electrical Drawings.

END OF SECTION 26 00 10

SECTION 26 05 19 CONDUCTORS AND CABLES

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 SUBMITTALS	1
1.04 QUALITY ASSURANCE	1
PART 2 PRODUCTS	2
2.01 COPPER BUILDING WIRE	2
2.02 METAL-CLAD CABLE, TYPE MC	2
2.03 CONNECTORS AND SPLICES	3
PART 3 EXECUTION	3
3.01 CONDUCTOR MATERIAL APPLICATIONS	3
3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS	3
3.03 INSTALLATION OF CONDUCTORS AND CABLES	3
3.04 CONNECTIONS	4
3.05 IDENTIFICATION	4
3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS	4
3.07 FIRESTOPPING	4
3.08 FIELD QUALITY CONTROL	4

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes:
 - 1. Building wires and cables rated 600V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Sections include the following:
 - 1. Division 26 Section "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.
 - 2. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.03 SUBMITTALS

- A. Field Quality-Control Test Reports
- B. Submit letter of compliance (intent) for general building wire and cable. Provide product data for the following:
 - 1. Metal-Clad Cable, Type MC

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 PRODUCTS

2.01 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- D. Conductor Insulation:
 - 1. Type THHN/THWN-2: Comply with UL 83.
 - 2. Type THW/THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 - 3. Type XHHW-2: Comply with UL 44.

2.02 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers:
 - 1. AFC Cable Systems
 - 2. Alpha Wire Company
 - 3. American Bare Conductor
 - 4. Belden
 - 5. Encore
 - 6. General Cable
 - 7. Okonite
 - 8. Service Wire Co.
 - 9. Southwire Company
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Comply with UL 1569.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
 - 1. Single circuit and multi-circuit with color-coded conductors for branch circuit distribution.
 - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- E. Conductors:
 - 1. Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- F. Ground Conductor: Insulated. Ground conductor sized as indicated on drawings (reduced ground conductor is not acceptable).
- G. Conductor Insulation:
 - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.
- H. Armor: Aluminum, interlocked.
- I. Jacket: PVC applied over armor.

2.03 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Refer to application schedule on the drawings
- B. Feeders and Branch Circuits: Solid or stranded for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. Each feeder shall be of the same conductor and insulation material (phase, neutral, and parallel).
- D. Use conductor not smaller than 14 AWG for control circuits,

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Refer to application schedule on the drawings
- B. Fire Alarm Circuits: Type THHN/THWN-2, in raceway.
- C. Class 1 Control Circuits: Type THHN/THWN-2, in raceway.
- D. Class 2 Control Circuits: Type THHN/THWN-2, in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 26 05 36 "Cable Trays for Electrical Systems" prior to installing conductors and cables.
- H. Support communication cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
- I. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- J. Provide a separate neutral conductor for each circuit unless multi-wire branch circuits are specifically indicated on the drawings.
- K. Electrical Contractor shall be responsible for de-rating of conductors as required by N.E.C. when more than three current carrying conductors are installed in a single raceway or cable. Neutral conductors shall be considered current carrying conductors.
- L. Type MC cable shall be supported and secured at intervals not exceeding 4'-0" in new construction
- M. AC/MC cable shall not be used for home runs to receptacle or distribution panels.
- N. Where AC/MC cable is permitted by the specifications, AC/MC cable shall not be bundled.

- O. Between support, hangers and termination no more than 3" deflection from the bottom of the cable to a horizontal line between the support/hanger or termination.
- P. Do not route conductors across roof without prior approval from engineer.

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- D. Clean conductor surfaces before installing lugs and connectors.
- E. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- F. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
- G. Use Sta-Kon connectors to terminate stranded conductors #10 AWG and smaller to screw terminals.
- H. Use insulated spring wire connectors with plastic caps (wire nuts) for copper conductor splices and taps, 10 AWG and smaller. Push-in style connectors are not permitted.
- I. Provide lugs suitable for bussing and conductor material used.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 33 "Raceways and Boxes."

3.07 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping".

3.08 FIELD QUALITY CONTROL

- A. Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
 - 1. Description: Test all feeders rated 100 A and above.
 - 2. Visual and Mechanical Inspection
 - a. Inspect cables for physical damage and proper connection in accordance with the one line diagram.
 - b. Test cable mechanical connections with an infrared survey.
 - c. Check cable color-coding against project Specifications and N.E.C. requirements.
 - 3. Electrical Tests
 - a. Perform insulation resistance test on each conductor with respect to ground and adjacent conductors. Applied potential to be 1000 volts dc for 1 minute.
 - b. Perform continuity test to insure proper cable connection.
 - 4. Test Values
 - a. Minimum insulation resistance values shall be not less than fifty mega-ohms.
- B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 05 26 GROUNDING AND BONDING

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 REFERENCES	1
1.04 PROJECT RECORD DOCUMENTS	2
1.05 QUALITY ASSURANCE	2
PART 2 PRODUCTS	2
2.01 MANUFACTURERS	2
2.02 GROUNDING CONDUCTORS	2
PART 3 EXECUTION	2
3.01 EQUIPMENT GROUNDING	2
3.02 CONNECTIONS	3
3.03 INSTALLATION	3
3.04 FIELD QUALITY CONTROL	3

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- B. Related Sections include the following:
 1. Division 26 Section "Electrical General Requirements".
 2. Division 26 Section "Conductors and Cables".

1.03 REFERENCES

- A. ASTM B 3: Specification for Soft or Annealed Copper Wire.
- B. ASTM B 8: Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
- C. ASTM B 33: Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.
- D. ASTM B 187: Specification for Copper, Bus Bar, Rod, and Shapes and General Purpose Rod, Bar, and Shapes.
- E. IEEE 81: Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
- F. IEEE 142: Grounding of Industrial and Commercial Power Systems.
- G. IEEE 837: Qualifying Permanent Connections Used in Substation Grounding.
- H. IEEE 1100 – 1992: Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.
- I. IEEE C2: National Electrical Safety Code.
- J. NETA MTS – 2001: Maintenance Testing Specifications.
- K. NFPA 70: National Electrical Code.
- L. NFPA 70B: Recommended Practice for Electrical Equipment Maintenance.
- M. NFPA 99: Health Care Facilities.

- N. NFPA 780: Lightning Protection Code.
- O. TIA/EIA 607: Commercial Building Grounding and Bonding Requirements Standard.
- P. UL 96: Lightning Protection Components.
- Q. UL 467: Grounding and Bonding Equipment.
- R. UL 486 A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- S. UL 486B: Wire Connectors for Use with Aluminum Conductors.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 26 "Electrical General Requirements".
- B. Accurately record actual locations of grounding electrodes and connections to building steel.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Refer to specification section "Electrical Testing."
- 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.
 - 1. Comply with UL 467.
- C. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.
- D. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
- E. Comply with ANSI/TIA/EIA-607 "Standard for Commercial Building Grounding and Bonding Requirements for Telecommunications".
- F. Comply with ANSI/IEEE 1100 -1992 "Powering and Grounding Sensitive Electronic Equipment".

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grounding Conductors and Cables:
 - a. Refer to Division 26 Section "Conductors and Cables".

2.02 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.

PART 3 EXECUTION

3.01 EQUIPMENT GROUNDING

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. In raceways, use insulated equipment grounding conductors.
- C. Install equipment grounding conductors in all feeders and circuits. Terminate each end on suitable lugs, bus or bushing.
- D. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- E. Verify specific equipment grounding requirements with the manufacturer's recommendations.

3.02 CONNECTIONS

- A. Equipment Grounding Conductor Terminations
 - 1. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
 - 2. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- B. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- C. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.03 INSTALLATION

- A. Equipment Grounding: Provide a permanent and continuous bonding of conductor enclosures, equipment frames, power distribution equipment ground busses, cable trays, metallic raceways, and other non-current carrying metallic parts of the electrical system.

3.04 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
 - 1. Inspect grounding and bonding system conductors and connections for tightness and proper installation and for compliance with the Drawings and Specifications.
 - 2. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	1
1.04 PERFORMANCE REQUIREMENTS	1
1.05 SUBMITTALS	1
1.06 QUALITY ASSURANCE	1
1.07 COORDINATION	2
PART 2 PRODUCTS	2
2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS	2
2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES	3
2.03 ROOF MOUNTED CONDUIT AND EQUIPMENT SUPPORTS	3
PART 3 EXECUTION	3
3.01 APPLICATION	3
3.02 SUPPORT INSTALLATION	3
3.03 INSTALLATION OF FABRICATED METAL SUPPORTS	4
3.04 INSTALLATION OF ROOF MOUNTED SUPPORTS	4
3.05 PAINTING	5

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 1. Hangers and supports for electrical equipment and systems.
- B. Related Sections include the following:
 1. Division 26 Section "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.05 SUBMITTALS

- A. Product Data: For the following:
 1. Steel slotted support systems.
 2. Nonmetallic slotted support systems.

1.06 QUALITY ASSURANCE

- A. Comply with NFPA 70.

1.07 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; a part of Atkore International..
 - b. B-Line, by Eaton..
 - c. GS Metals Corp.
 - d. Pentair Electrical & Fastening Solutions.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; a part of Atkore International.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 4. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) B-Line by Eaton.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 5. Toggle Bolts: All-steel springhead type.
 - 6. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

2.03 ROOF MOUNTED CONDUIT AND EQUIPMENT SUPPORTS

- A. General: Shop- or field- fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted conduit and equipment.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-Line by Eaton; Dura-Blok.
 - 2. MIRO Industries.
 - 3. Pentair Electrical & Fastening Solutions; Caddy Pyramid.
 - 4. Pipe Pier Support Systems; Pipe Piers.
- C. Adjustable Compact Stand: Recycled rubber base unit with integral threaded coupling capable of accepting 3/8-16 threaded rod, or 1-5/8 inch by 1-5/8 inch metal strut and various supporting elements.
- D. Multiple-Conduit and Equipment Stand: Assembly of bases, vertical and horizontal members, and conduit supports, for roof installation without membrane penetration.
 - 1. Bases: One or more adjustable compact stand bases.
 - 2. Vertical Members: Two or more protective-coated-steel channels.
 - 3. Horizontal Member: Protective-coated-steel channel.
 - 4. Supports: Standard strut clamps, hangers, and accessories.

PART 3 EXECUTION

3.01 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with:
 - a. Two-bolt conduit clamps
 - b. Single-bolt conduit clamps
- D. Support single runs of MC cable using spring-steel clamps from suspended ceiling hangers, hanger wire or building structure at intervals not to exceed three feet. Do not support MC cable from ceiling grid.

3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel:
 - a. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 - b. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
 - c. Spring-tension clamps.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel support systems attached to substrate.
- E. Slotted support systems applications:
 - 1. Indoor dry and damp Locations: Painted Steel
 - 2. Outdoors and interior wet locations: Galvanized Steel
 - 3. Corrosive Environments, including pool equipment rooms: Nonmetallic
- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- G. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- H. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- I. Obtain permission from Architect/Engineer before drilling or cutting structural members.
- J. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- K. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- L. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.
- M. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- N. The Contractor shall replace all supports and channels that sag, twist, and/or show signs of not providing proper structural support, to the equipment, it is intended for, as determined by the Owner and Architect/Engineer. All costs associated with replacing supports and steel channels shall be incurred by the Contractor.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 INSTALLATION OF ROOF MOUNTED SUPPORTS

- A. Install in accordance with manufacturer's instructions.
- B. If gravel top roof, gravel must be removed around and under support.

- C. Consult roofing manufacturer for roof membrane compression capacities. If required, a compatible sheet of roofing material (rubber pad) may be required under rooftop support to disperse concentrated loads and add further membrane protection.
- D. Utilize properly sized clamps and accessories to suit conduit sizes.
- E. Provide vertical steel channel members as required for elevated conduit supports where required for clearances, coordination with other roof mounted systems or derating.

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 RACEWAYS AND BOXES

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	1
1.04 SUBMITTALS	2
1.05 QUALITY ASSURANCE	2
1.06 COORDINATION	2
PART 2 PRODUCTS	2
2.01 METAL CONDUIT AND TUBING	2
2.02 FIRE ALARM EMT	3
2.03 METAL WIREWAYS	3
2.04 BOXES, ENCLOSURES, AND CABINETS	3
2.05 GROUT	3
PART 3 EXECUTION	3
3.01 RACEWAY APPLICATION	3
3.02 INSTALLATION	4
3.03 SLEEVE INSTALLATION FOR ELECTRICAL AND COMMUNICATIONS PENETRATIONS	6
3.04 SLEEVE-SEAL INSTALLATION	6
3.05 FIRESTOPPING	6
3.06 PROTECTION	6
3.07 CLEANING	6

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 26 Section, "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, manholes and underground utility construction.
 - 2. Division 07 Section, "Penetration Firestopping" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
 - 3. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings, and for access floor boxes and service poles.
 - 4. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RNC: Rigid nonmetallic conduit.
- H. PVC: Polyvinyl Chloride.
- I. HDPE: High Density Polyethylene.

1.04 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Manufacturer Seismic Qualification Certification: Submit certification that enclosures, cabinets, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.06 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 PRODUCTS

2.01 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflex Inc.
 - 3. Allied Tube Triangle Century.
 - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 5. International Metal Hose.
 - 6. Electri-Flex Co
 - 7. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
 - 8. LTV Steel Tubular Products Company – Manhattan/CDT/Cole-Flex.
 - 9. Maverick.
 - 10. O-Z Gedney; unit of General Signal.
 - 11. Wheatland.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. EMT: ANSI C80.3.
- E. FMC: Zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket.
- G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Fittings for EMT: Steel, compression type.
2. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

2.02 FIRE ALARM EMT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Allied Tube Triangle Century.
- B. EMT conduit with bright red topcoat; Fire Alarm EMT.
- C. EMT and Fittings: ANSI C80.3.

2.03 METAL WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Hoffman.
 2. Square D.
- B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- E. Wireway Covers: Hinged type.
- F. Finish: Manufacturer's standard enamel finish.

2.04 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Shall be used within walls or ceiling.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Shall be used in all exposed, non-recessed, locations.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover. Shall be used in areas exposed to water.
- E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- F. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.05 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

- A. Provide raceways in interior and exterior locations in accordance with the "Raceway Application Matrix" included on the drawings.
- B. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 - 2. EMT: Use setscrew, fittings. Comply with NEMA FB 2.10.
 - 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

3.02 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Install temporary closures to prevent foreign matter from entering raceways.
- F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- H. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
 - 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- I. Support conduit within 12 inches of enclosures to which attached.
- J. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - 1. Run parallel or banked raceways together on common supports.
 - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- P. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

- Q. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- S. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where conduits route through, to, or from a hazardous classified space (Class I or II), provide proper seal offs when exiting or entering the hazardous classified space.
 - 3. Where conduits pass between spaces that are maintained at two different vapor pressures.
 - 4. Where otherwise required by NFPA 70.
- T. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- U. Flexible Conduit Connections: Comply with NEMA RV3. Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- V. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- W. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- X. Locate boxes so that cover or plate will not span different building finishes.
- Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- AA. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- BB. Route conduits in finished areas with exposed ceilings at underside of structural deck or as high as possible.

3.03 SLEEVE INSTALLATION FOR ELECTRICAL AND COMMUNICATIONS PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Through-Penetration Firestop Systems."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- G. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- H. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."
- I. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- J. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.04 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.05 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Through-Penetration Firestop Systems."

3.06 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.07 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 26 05 33

SECTION 26 05 53 ELECTRICAL IDENTIFICATION

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 QUALITY ASSURANCE	1
1.04 COORDINATION	1
PART 2 PRODUCTS	1
2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS	2
2.02 CONDUCTOR, COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS ..	2
2.03 EQUIPMENT IDENTIFICATION LABELS	2
2.04 MISCELLANEOUS IDENTIFICATION PRODUCTS	2
2.05 WIRING DEVICE IDENTIFICATION	2
PART 3 EXECUTION	2
3.01 APPLICATION	2
3.02 INSTALLATION	3

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 1. Identification for raceway and metal-clad cable.
 2. Identification for conductors and communication and control cable.
 3. Underground-line warning tape.
 4. Warning labels and signs.
 5. Instruction signs.
 6. Equipment identification labels.
 7. Miscellaneous identification products.

1.03 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with 29 CFR 1910.145.

1.04 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
 - 1. Power Circuits: Black letters on an orange field.
 - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.02 CONDUCTOR, COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.03 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background. Minimum letter height shall be 3/8 inch .
- B. Outdoor Equipment Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.04 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength: 50 lb, minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.05 WIRING DEVICE IDENTIFICATION

- A. Description: Self adhesive label with black upper case letters on clear polyester label, font size 7.

PART 3 EXECUTION

3.01 APPLICATION

- A. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number as indicated on Drawings. Identify control circuits by control wire number as indicated on shop drawings.
- B. Branch-Circuit Conductor Identification: Mark junction box covers in indelible ink with the panel and breaker numbers of other circuits contained within.
- C. Conductor Identification: Locate at each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection or termination point.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- E. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label mechanically secured.
 - b. Outdoor Equipment: Stenciled.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 2. Equipment to Be Labeled: If included on project. All items may not be on project.
 - a. Disconnect switches.
 - b. Breakers or switches at distribution panels.
- F. Wiring Device Identification Labels: On each faceplate install circuit designation label that is consistent with panelboard directories, and as-built plan drawings. Apply labels to receptacle faceplates centered below bottom outlet. Apply labels to toggle switch faceplates on backside.

3.02 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location:
 1. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
 2. Conduit Markers: Provide identification for each power conduit containing conductors rated 400A or greater.
- C. Apply identification devices to surfaces after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

- H. Label information arrangement for 3 lines of text.
1. Line one shall describe the panel or equipment. Line one example: "DP-XX," RP-XX," "T-XX," "EF-XX," etc.
 2. Line two shall describe the first disconnecting means feeding this panel or equipment. Line two example: "Fed from DP-XX," "Fed from RP-XX," etc.
 3. Line three indicates that location of the disconnecting means as identified in line two. Line three example: "First Floor Elect. Rm #XXX."
 4. Line four shall include "Via T-XX" when panel or equipment is fed from a transformer.
- I. Examples:

RP-1A FED FROM DP-1A ELECTRICAL ROOM A100 VIA T-1A	EF-1 FED FROM MCC-1A MECHANICAL ROOM F101	LP-1A LOCATED IN ELECTRICAL ROOM A100
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- J. Fusible Enclosed Switches and Distribution Equipment: Install self-adhesive vinyl label indicating fuse rating and type on the outside of door on each fused switch.
- K. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.
- L. Degrease and clean surface to receive nameplates.
- M. Install nameplate and labels parallel to equipment lines.
- N. Secure nameplate to equipment front using screws.
- O. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- P. Identify conduit using field painting where required.
- Q. Paint red colored band on each fire alarm conduit and junction box.
- R. Paint bands 10 feet on center, and 4 inches minimum in width.

END OF SECTION 26 05 53

SECTION 26 09 23 LIGHTING CONTROL DEVICES

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 REFERENCES	1
1.04 DEFINITIONS	2
1.05 SUBMITTALS	2
1.06 QUALITY ASSURANCE	2
1.07 COORDINATION	2
1.08 DELIVERY, STORAGE, AND HANDLING	2
PART 2 PRODUCTS	2
2.01 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS	2
2.02 OCCUPANCY SENSORS	2
PART 3 EXECUTION	4
3.01 OCCUPANCY SENSOR INSTALLATION	4
3.02 WIRING INSTALLATION	4
3.03 IDENTIFICATION	4
3.04 FIELD QUALITY CONTROL	4
3.05 ADJUSTING	5

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Occupancy sensors.
- B. Related Sections include the following:
 - 1. Division 26 Section "Electrical General Requirements".
 - 2. Division 26 Section "Wiring Devices" for wall-box dimmers and manual light switches.

1.03 REFERENCES

- A. IEEE C62.41: Guide for Surge Voltages in Low-Voltage AC Power Circuits.
- B. IEEE C136.10: Standard for Roadway Lighting Equipment Locking-Type Photocontrol Devices and Mating Receptacle Physical and Electrical Interchangeability and Testing.
- C. NEMA ICS 2: Industrial Control and Systems Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC Part 8: Disconnect Devices for Use in Industrial Control Equipment.
- D. NFPA 70: National Electrical Code.
- E. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- F. UL 486B: Wire Connectors for Use with Aluminum Conductors.
- G. UL 773: Plug-in, Locking Photocontrols for Use with Area Lighting.
- H. UL 773A: Nonindustrial Photoelectric Switches for Lighting Control.
- I. UL 917: Clock Operated Switches.
- J. UL 1449: Surge Protective Devices.
- K. UL 1598: Luminaires.
- L. NECA 130-2010: Installing and Maintaining Wiring Devices.

1.04 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.
- C. ULTRASONIC: Active emission of at least 35 kHz sound waves, using Doppler reflectance to detect motion.
- D. MICROPHONIC: Passive reception to listen for continued occupancy, with circuitry to filter out white noise.
- E. MULTI-Tech: Using PIR and ultrasonic or microphonic technologies in one sensor.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated including physical data and electrical performance.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Lighting plan showing location, orientation, and coverage area of each sensor.
 - 2. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. Include the following:
 - 1. Description of operation and servicing procedures.
 - 2. List of major components.
 - 3. Recommended spare parts.
 - 4. Programming instructions and system operation procedures.

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.07 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Coordinate interface of lighting control devices with temperature controls specified in Division 23.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under provisions of Division 26 Section "Electrical General Requirements".
- B. Store and protect products under provisions of Division 26 Section "Electrical General Requirements".

PART 2 PRODUCTS

2.01 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

- A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

2.02 OCCUPANCY SENSORS

- A. General
 - 1. Coordinate occupancy sensor locations, coverages and required quantities with manufacturer's recommendations. Coverage areas indicated on the Drawings are for minor motion (6 to 8 inches of hand movement). Provide additional occupancy sensors

- and control units as required to achieve complete minor motion coverage of the space indicated.
2. Adjust occupancy sensors and test that complete minor motion coverage is obtained in accordance with Part 3. Provide written confirmation of testing to owner, architect and engineer.
 3. Provide occupancy sensors with a bypass switch to override the "ON" function in the event of sensor failure.
 4. Provide occupancy sensors with an LED indicator indicating when motion is being detected during testing and normal operation of the sensor.
 5. Provide occupancy sensors and occupancy sensor control units from single manufacturer.
- B. Wall Switch Passive Infrared Occupancy Sensor
1. Manufacturers:
 - a. Perfect Sense – PS-PWS
 - b. Wattstopper PW-100.
 - c. Hubbell Building Automation SOM 101.
 - d. Greengate OSW-P-0451-W.
 - e. Sensorswitch WSD.
 - f. Philips LRS2210.
 - g. Leviton ODS10-IDW.
 2. Description: Wall mounted, 180° coverage, passive infrared sensing occupancy sensor.
 - a. Electrical Characteristics: Capable of switching up to 800W fluorescent or incandescent lighting loads at 120V and 1200 watts fluorescent loads at 277V.
 - b. Functions: Automatic ON/Automatic OFF, or Manual ON/Automatic OFF operation, field selectable. Integral manual override pushbutton switch.
 - c. Adjustments: User adjustable sensitivity and time delay. Time delay shall be adjustable from 30 seconds to 30 minutes.
 - d. Device Body: White, plastic with momentary on/off override pushbutton designed to mount in a standard switch box with "decora" style switch plate.
- C. 360° Ceiling Mounted Dual Technology Occupancy Sensor
1. Manufacturers:
 - a. Perfect Sense CDS.
 - b. Wattstopper DT 300
 - c. Hubbell Building Automation "OMNI-DT" Series.
 - d. Greengate OMC-DT-2000-R.
 - e. Sensorswitch CM-PDT-R.
 - f. Philips LRM2255.
 - g. Leviton OSC10-M0W.
 2. Description: Ceiling mounted, 360° coverage, multi-tech sensing occupancy sensor.
 - a. Housing: White, thermoplastic, tamper resistant ceiling mount.
 - b. Functions: Automatic ON must sense motion from both ultrasonic and infrared sensing elements. Either technology shall maintain ON, with adjustable time delays.
 - c. Adjustments: User adjustable sensitivity adjustment shall be provided for each sensing technology. Time delay shall be adjustable from 30 seconds to 30 minutes.
 - d. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
 - e. Manual override function.

PART 3 EXECUTION

3.01 OCCUPANCY SENSOR INSTALLATION

- A. Install wall mounted occupancy sensors as noted on plan. Arrange occupancy sensors with adjacent switch devices so that device plates line-up and are equally spaced.
- B. Install ceiling mounted sensors at approximate locations as indicated on plan. Sensor manufacturer shall provide quantity of sensors as required to provide complete coverage for rooms.
- C. Locate sensors such that motion through open doors will not falsely activate sensors.
- D. Do not locate ultrasonic sensors within six feet of supply air diffusers.
- E. Locate infrared sensors to avoid obstructions.
- F. Provide the services of a manufacturer's representative for commissioning of occupancy sensor installation. This shall include consultation on layout and location prior to installing sensors, testing of each sensor for compliance with Contract Documents and field adjustment and fine tuning after installation is complete. Provide written confirmation of testing to the Owner, Architect and Engineer.
- G. Field adjustments shall take place in the presence of the owner and the engineer. This shall include owner training on adjustment techniques for the occupancy sensors.

3.02 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Conductors and Cables".
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."
- B. Label time switches and contactors with a unique designation.

3.04 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify actuation of each sensor and adjust time delays.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.05 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION 26 09 23

SECTION 26 09 99 ELECTRICAL TESTING

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS.....	1
1.02 SECTION INCLUDES	1
1.03 REFERENCES	1
1.04 QUALIFICATIONS.....	2
1.05 PERFORMANCE REQUIREMENTS	2
1.06 TEST INSTRUMENT CALIBRATION.....	3
1.07 TEST REPORTS	3
PART 2 PRODUCTS	3
PART 3 EXECUTION.....	4
3.01 THERMOGRAPHIC SURVEY.....	4

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Related Sections include the following:
 1. Division 26 Section "Electrical General Requirements."
 2. Division 26 Section "Conductors and Cables."
 3. Division 26 Section "Grounding and Bonding."
 4. Division 26 Section "Enclosed Switches."

1.02 SECTION INCLUDES

- A. The Electrical Contractor shall engage the services of a recognized corporately independent N.E.T.A. certified testing firm for the purpose of performing inspections and tests as herein specified
- B. The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
- C. It is the intent of these tests to assure that all tested electrical equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with design Specifications.
- D. The test and inspections shall determine suitability for energization.
- E. Equipment to be tested and inspected shall be the equipment shown on the one line diagram and schedules as required by part three of each individual Specification Section. In addition, all equipment that is part of an emergency distribution system shall be tested.

1.03 REFERENCES

- A. All inspections and tests shall be in accordance with the latest version of the following codes and standards except as provided otherwise herein.
 1. National Electrical Manufacturer's Association - NEMA
 2. American Society for Testing and Materials - ASTM
 3. Institute of Electrical and Electronic Engineers - IEEE
 4. InterNational Electrical Testing Association - NETA Acceptance Testing Specifications - ATS-2017
 5. InterNational Electrical Testing Association - NETA Maintenance Testing Specifications- MTS-2015
 6. American National Standards Institute - ANSI C2: National Electrical Safety Code
 7. State and Local Codes and Ordinances
 8. Insulated Cable Engineers Association - ICEA
 9. Association of Edison Illuminating Companies - AEIC

10. Occupational Safety and Health Administration
11. National Fire Protection Association - NFPA
 - a. ANSI/NFPA 70: National Electrical Code
 - b. ANSI/NFPA 70B: Electrical Equipment Maintenance
 - c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces
 - d. ANSI/NFPA 101: Life Safety Code

1.04 QUALIFICATIONS

- A. The testing firm shall be a corporately independent testing organization, which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.
- B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- C. The lead, on site, technical person and at least 50% of the on site crew shall be currently certified by the InterNational Electrical Testing Association (NETA) or National Institute for Certification in Engineering Technologies in Electrical Power Distribution System Testing.
- D. The testing firm shall only utilize technicians who are regularly employed by the firm on a full-time basis for testing services.
- E. The Contractor shall submit proof of the above qualifications with bid proposal.
- F. The terms used herewithin such as Test Agency, Test Contractor, Testing Laboratory, or Contractor Test Company, shall be construed to mean the testing organization.
- G. Acceptable Testing Firms:
 1. Northern Electrical Testing; Phone (248) 689-8980.
 2. Utilities Instrumentation Services; Phone (734) 424-1200.
 3. Emerson/High Voltage Maintenance Corporation; Phone (248) 305-5596.
 4. Powertech Services, Inc.; Phone (810) 720-2280.
 5. Magna Electric; Phone (248) 667-9492.
 6. Power Plus Engineering, Inc. Phone (248) 344-0200.

1.05 PERFORMANCE REQUIREMENTS

- A. The Electrical Contractor shall supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the power requirements.
- B. The Electrical Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.
- C. The testing firm shall notify the Owner's Representative prior to commencement of any testing.
- D. Any system, material or workmanship, which is found defective on the basis of acceptance tests, shall be reported to the Engineer. The Electrical Contractor shall correct all defects.
- E. The testing organization shall maintain a written record of all tests and shall assemble and certify a final test report.
- F. Safety and Precautions
 1. Safety practices shall include, but are not limited to, the following requirements:
 - a. Occupational Safety and Health Act.
 - b. Accident Prevention Manual for Industrial Operations, National Safety Council.
 - c. Applicable state and local safety operating procedures.
 - d. NETA Safety/Accident Prevention Program.
 - e. Owner's safety practices.
 - f. National Fire Protection Association - NFPA 70E.
 - g. American National Standards for Personnel Protection.
 2. All tests shall be performed with apparatus de-energized except where otherwise specifically required.
 3. The testing organization shall have a designated safety representative on the project to supervise operations with respect to safety.

1.06 TEST INSTRUMENT CALIBRATION

- A. Test Instrument Calibration
 - 1. The testing firm shall have a calibration program, which assures that all applicable test instruments are maintained within rated accuracy.
 - 2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.
 - 3. Instruments shall be calibrated in accordance with the following frequency schedule:
 - a. Field instruments: Analog - 6 months maximum Digital - 12 months maximum
 - b. Laboratory instruments: 12 months
 - c. Leased specialty equipment: 12 months
(Where accuracy is guaranteed by Lessor)
 - 4. Dated calibration labels shall be visible on all test equipment.
 - 5. Records must be kept up-to-date which show date and results of instruments calibrated or tested.
 - 6. An up-to-date instrument calibration instruction and procedures shall be maintained for each test instrument.
 - 7. Calibrating standard shall be of higher accuracy than that of the instrument tested.
- B. Field Test Instrument Standards
 - 1. All equipment used for testing and calibration procedures shall exhibit the following characteristics:
 - a. Maintained in good visual and mechanical condition.
 - b. Maintained in safe, operating condition.
- C. Suitability of Test Equipment
 - 1. All test equipment shall be in good mechanical and electrical condition.
 - 2. Selection of metering equipment should be based on knowledge of the waveform of the variable being measured. Digital multi-meters may be average of RMS sensing and may include or exclude the dc component. When the variable contains harmonics of dc offset and, in general, any deviation from a pure sine wave, average sensing, average measuring RMS scaled meters may be misleading. Use of RMS measuring meters is recommended.
 - 3. Field test metering used to check power system meter calibration must have any accuracy higher than that of the instrument being checked.
 - 4. Accuracy of metering in test equipment shall be appropriate for the test being performed.
 - 5. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and tested equipment.

1.07 TEST REPORTS

- A. A test report shall be generated for each piece of major equipment or groups of equipment and shall include the following:
 - 1. A list of visual and mechanical inspections required by Division 26 Specification Sections in a checklist or similar format.
 - 2. Test reports, including test values where applicable, for all required electrical tests. Clearly indicate where test values fall outside of the limits of recommended values.
 - 3. Summary and interpretation of test results detailing problems located and recommended corrective measures.
 - 4. Record of infrared scan and photos showing potential problem locations.
 - 5. Signed and dated by the testing firm field superintendent stating that all required tests have been completed.
- B. Test reports shall be furnished to the Architect/Engineer within 14 days of the completion each test on an ongoing basis. Original copies of the reports shall be furnished directly to the Architect/Engineer by the testing company prior to formal submittal via the Contractors.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 THERMOGRAPHIC SURVEY

- A. Visual and Mechanical Inspection
 - 1. Remove all necessary covers prior to scanning.
 - 2. Inspect for physical, electrical, and mechanical condition.
- B. Equipment to be Scanned
 - 1. All components of the distribution system down to and including branch circuit panelboards and motor control centers. Return 3 months after equipment has been energized and loaded to do a final scan of all equipment.
- C. Provide report indicating the following:
 - 1. Problem area (location of "hot spot").
 - 2. Temperature rise between "hot spot" and normal or reference area.
 - 3. Cause of heat rise.
 - 4. Phase unbalance, if present.
 - 5. Areas scanned.
- D. Test Parameters
 - 1. Scanning distribution system with ability to detect 1°C between subject area and reference at 30°C.
 - 2. Equipment shall detect emitted radiation and convert detected radiation to visual signal.
 - 3. Infrared surveys should be performed during periods of maximum possible loading but not less than twenty percent (20%) of rated load of the electrical equipment being inspected.
- E. Test Results
 - 1. Interpretation of temperature gradients requires an experienced technician. Some general guidelines are:
 - a. Temperature gradients of 37°F to 44.6°F indicate possible deficiency and warrant investigation.
 - b. Temperature gradients of 44.6°F to 59°F indicate deficiency; repair as time permits.
 - c. Temperature gradients of 61°F and above indicate major deficiency; repair immediately.

END OF SECTION 26 09 99

SECTION 26 27 26 WIRING DEVICES

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	1
1.04 REFERENCES	1
1.05 SUBMITTALS	2
1.06 QUALITY ASSURANCE	2
PART 2 PRODUCTS	2
2.01 RECEPTACLES	2
2.02 WALL SWITCHES	3
2.03 WALL PLATES	3
2.04 FINISHES	3
PART 3 EXECUTION	4
3.01 INSTALLATION	4
3.02 IDENTIFICATION	4
3.03 CONNECTIONS	4
3.04 FIELD QUALITY CONTROL	4

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Single and duplex receptacles
 - 2. Ground-fault circuit interrupter receptacles
 - 3. Single- and double-pole snap switches and dimmer switches.
 - 4. Device wall plates.
 - 5. Receptacles with integral USB charger.

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. PVC: Polyvinyl chloride.
- D. RFI: Radio-frequency interference.
- E. SPD: Surge protective devices.
- F. UTP: Unshielded twisted pair.
- G. USB: Universal serial bus.

1.04 REFERENCES

- A. DSCC W-C-596G: Federal Specification Connector, Electrical, Power, General Specification.
- B. DSCC W-C-896F: Federal Specification Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification).
- C. IEC 309-1, Part 1: General Requirements: Plugs, Socket-Outlets and Couplers for Industrial Purposes
- D. NEMA FB 11: Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations.

- E. NEMA WD 1: General Requirements for Wiring Devices.
- F. NEMA WD 6: Wiring Device – Dimensional Requirements.
- G. UL 20: General-Use Snap Switches.
- H. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- I. UL 486B: Wire Connectors for Use with Aluminum Conductors.
- J. UL 498: Electrical Attachment Plugs and Receptacles.
- K. UL 943: Ground Fault Circuit Interrupters.
- L. NECA 130-2010: Installing and Maintaining Wiring Devices.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations for each type of product indicated.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

PART 2 PRODUCTS

2.01 RECEPTACLES

- A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498. Configuration 5-20R duplex receptacle.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell: 5352.
 - b. Eaton/Arrow Hart: 5352.
 - c. Bryant: 5362.
 - d. Legrand, Pass & Seymour: 5362, PT5362 (use with PTR6STRNA prewired pigtail connector).
- B. GFCI Receptacles: Straight blade, non-feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems GF20-LA.
 - b. Eaton/Arrow Hart Wiring Devices VGFH20.
 - c. Leviton 7899.
 - d. Legrand, Pass & Seymour: 2097, PT2097 (use with PTR6STRNA prewired pigtail connector).
- C. Self-Test GFCI's: Duplex GFCI Convenience Receptacles, 125 V, 20 A. Comply with NEMA WD1, NEMA WD6 configuration 5-20R, UL 498, Federal Specification W-C-596 and UL 943, Class A, and include indicator light that is lighted when device is tripped. Must have self-test feature and SafeLock protection™: conducts an automatic test every second, ensuring its always ready to protect. If the device fails the self-test, the indicator light flashes to signal that the GFCI should be replaced. With SafeLock Protection™, if critical components are damaged and ground fault protection is lost, power to receptacle must be discontinued.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work, include, but are not limited to the following:

2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Legrand, Pass & Seymour: 2097 or 2097TR.
 - b. Eaton/Arrow Hart Wiring Devices SGF20.
- D. Commercial Grade Tamper Resistant Receptacles with integral USB charger:
 1. Configuration: 5-20R, 2P, 3W grounding, straight blade, tamper resistant duplex receptacle with two USB charging ports, decorator style.
 - a. 20A circuit feed through.
 - b. Comply with UL 498 and UL 1310.
 - c. Comply with Part 16 of the FCC rules.
 - d. Complies with Federal Specification DSCC W-C 596G testing requirements.
 2. USB Charging 3.0A (minimum), 5VDC dual ports.
 - a. Comply with battery charging specification USB BC1.2
 - b. Compatible with USB 1.1/2.0/3.0 devices, including Apple products.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Wiring Device- USB20X2-x
 - b. Eaton/Arrow Hart Wiring Devices – TR7756-x.
 - c. Legrand, Pass & Seymour: TR5362USB Full Duplex and USB.

2.02 WALL SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Hubbell Incorporated; Wiring Device-Kellems 1220 Series.
 2. Eaton/Arrow Hart Wiring Devices AH1220 Series.
 3. Leviton 1220 Series.
 4. Bryant 4900 Series.
 5. Legrand, Pass & Seymour; Wiring Devices Division PS20AC Series.
- B. Device body: Plastic handle.
- C. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
- D. Snap Switches: Heavy Duty specification grade, quiet type; rated 20A., 120-277 V AC.
- E. Provide single-pole, two-pole, three-way and four-way switches as indicated.
- F. Provide pilot light where indicated.
- G. Provide key type where indicated. Furnish four keys to Owner.
- H. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.
 1. Switch: 20 A, 120/277-V ac.
 2. Receptacle: NEMA WD 6, Configuration 5-20R.

2.03 WALL PLATES

- A. Manufacturers:
 1. Provide wall plates and corresponding wiring devices from same manufacturer.
- B. Single and combination types to match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces:
 - a. 0.035-inch- (1-mm-) thick, satin-finished stainless steel
 3. Material for Unfinished Spaces:
 - a. Smooth, high-impact thermoplastic.

2.04 FINISHES

- A. Color:
 1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70.
 2. Wall Switches: As selected by Architect, unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Prior to installation of devices, verify wall openings are neatly cut and will be completely covered by wall plates, clean debris from outlet boxes and provide extension rings to bring outlet boxes flush with finished surface.
- C. Install devices and assemblies level, plumb, and square with building lines.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging according to manufacturer's written instructions.
- E. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.
- F. Arrangement of Devices:
 - 1. Coordinate locations of outlet boxes provided under Division 26 Section "Raceways and Boxes" to obtain mounting heights indicated on Drawings.
 - 2. Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top.
 - 3. Where multiple switches, dimmers, and/or occupancy sensors are adjacent to each other, provide a single cover plate. Custom fabricate, if required, for all combinations. Provide separate boxes or barriers as required for the application.
 - 4. Install horizontally mounted receptacles with grounding pole on the left.
 - 5. Install GFCI receptacles so that the "Push To Test" and "Reset" designations can be read correctly. If printed in both directions, install with ground pole on top.
 - 6. Install switches with OFF position down.
- G. Install cover plates on switch, receptacle, and blank outlets in finished areas.
- H. Use oversized plates for outlets installed in masonry walls.
- I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- J. Remove wall plates and protect devices and assemblies during painting.
- K. Adjust devices and wall plates to be flush and level. Three corners of wall plates must be in contact with wall surfaces. Devices shall be solidly mounted against the box.

3.02 IDENTIFICATION

- A. Comply with Division 26 Section "Electrical Identification."
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use adhesive label as specified in Division 26 Section "Electrical Identification" with black-filled lettering on face of wall plate, and durable wire markers or tags inside outlet boxes.

3.03 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding." Connect wiring device grounding terminal to outlet box with bonding jumper. Use of quick ground strap or screw is not acceptable.
- B. Connect wiring according to Division 26 Section "Conductors and Cables." Connect wiring devices by wrapping conductor around screw terminal or by using back wiring and tightening the screw securely.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Inspect each wiring device for defects.

2. Operate each wall switch with circuit energized and verify proper operation.
 3. After installing wiring devices and after electrical circuitry has been energized, test each receptacle for proper polarity, ground continuity, and compliance with requirements.
 4. Test each GFCI receptacle for proper operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 26 27 26

SECTION 26 28 13

FUSES

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 SUBMITTALS	1
1.04 QUALITY ASSURANCE	1
1.05 PROJECT CONDITIONS	2
1.06 COORDINATION	2
1.07 EXTRA MATERIALS	2
PART 2 PRODUCTS	2
2.01 MANUFACTURERS	2
2.02 CARTRIDGE FUSES	2
PART 3 EXECUTION	2
3.01 EXAMINATION	2
3.02 INSTALLATION	2
3.03 IDENTIFICATION	2

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Cartridge fuses rated 600 V and less for use in switches.

1.03 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
 - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 2. Let-through current curves for fuses with current-limiting characteristics.
 - 3. Time-current curves, coordination charts and tables, and related data.
 - 4. Fuse size for elevator feeders and elevator disconnect switches.
- B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - 1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:
 - a. Let-through current curves for fuses with current-limiting characteristics.
 - b. Time-current curves, coordination charts and tables, and related data.
 - c. Ambient temperature adjustment information.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- C. Comply with:
 - 1. NEMA FU 1 – Low Voltage Cartridge Fuses.
 - 2. NFPA 70 – National Electrical Code.
 - 3. UL 198C – High-Interrupting-Capacity Fuses, Current-Limiting Types.
 - 4. UL 198E – Class R Fuses.
 - 5. UL 512 – Fuseholders.

1.05 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.06 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.07 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Quantity equal to 10% percent of each fuse type and size, but no fewer than one of each type and size.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.02 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.
 - 1. Other Branch Circuits: Class RK1, time delay.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Fuses shall be shipped separately. Any fuses shipped installed in equipment, shall be replaced by the Electrical Contractor with new fuses as specified above prior to energization at no additional expense to Owner. All fuses shall be stored in moisture free packaging at job site and shall be installed immediately prior to energization of the circuit in which it is applied.
- B. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- C. Install spare-fuse cabinet(s).

3.03 IDENTIFICATION

- A. Install labels indicating fuse rating and type on outside of the door on each fused switch.

END OF SECTION 26 28 13

SECTION 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	1
1.04 REFERENCES	1
1.05 SUBMITTALS	2
1.06 QUALITY ASSURANCE	2
1.07 PROJECT CONDITIONS	3
1.08 COORDINATION	3
PART 2 PRODUCTS	3
2.01 MANUFACTURERS	3
2.02 FUSIBLE AND NONFUSIBLE SWITCHES	3
2.03 MOLDED-CASE CIRCUIT BREAKERS	3
2.04 ENCLOSURES	4
PART 3 EXECUTION	4
3.01 EXAMINATION	4
3.02 INSTALLATION	4
3.03 IDENTIFICATION	4
3.04 FIELD QUALITY CONTROL	4
3.05 ADJUSTING	5
3.06 CLEANING	5

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 26 Section "Fuses".

1.02 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 1. Fusible switches.
 2. Nonfusible switches.
 3. Molded-case circuit breakers.
 4. Molded-case switches.
 5. Enclosures.
- B. Related Sections:
 1. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

1.03 DEFINITIONS

- A. GD: General duty.
- B. GFCI: Ground-fault circuit interrupter.
- C. HD: Heavy duty.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

1.04 REFERENCES

- A. NECA 1: Practices for Good Workmanship in Electrical Contracting.

- B. NETA ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- C. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NEMA AB 1: Molded Case Circuit Breakers and Molded Case Switches.
- E. NEMA FU 1: Low Voltage Cartridge Fuses.
- F. NEMA KS 1: Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- G. NEMA PB1.1: General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
- H. NEMA PB2.1: General Instructions for Proper Installation, Operation, and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
- I. NFPA 70: National Electrical Code.

1.05 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current rating.
 - 4. UL listing for series rating of installed devices.
 - 5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Qualification Data: For testing agency.
- D. Field quality-control test reports including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Manufacturer's field service report.
- F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 2. Altitude: Not exceeding 6600 feet.

1.08 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers:
1. Eaton Corporation; Cutler-Hammer Products.
 2. General Electric Co.; Electrical Distribution & Control Division.
 3. Siemens Industries, Inc.
 4. Square D/Group Schneider.
- B. Nonfusible Switch: NEMA KS 1, quick make, quick-break load interrupter enclosed knife switch Type HD, externally operable lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Accessories:
1. Provide early break auxiliary contacts in motor disconnect switches for motors that are fed from variable frequency controllers.
 2. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 3. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
 4. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.03 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers:
1. Square D/Group Schneider.
- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. GFCI Circuit Breakers: Single- and two-pole configurations with 5 or 30-mA trip sensitivity as required.
- C. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
1. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.

2. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Enclosure: Provide handle capable of being locked in the open position with padlock.

2.04 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 1. Indoor Dry Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R.
 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Install switches with off position down.
- D. Install NEMA KS 1 enclosed switch where indicated for motor loads ½ HP and larger and equipment loads greater than 30A.
- E. Install toggle disconnect switch, surface mounted, where indicated for motor loads less than ½ HP and equipment loads 30A. and less.
- F. Install fuses in fusible disconnect switches.
- G. Install flexible liquid tight conduit from toggle disconnect switch to portable equipment. Leave a 6'-0" whip.
- H. Install flexible liquid tight conduit from toggle disconnect switch to stationary equipment.
- I. Support enclosures independent of connecting conduit or raceway system.
- J. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Electrical Identification."
- C. Provide adhesive label as specified in Division 26 Section "Electrical Identification" on inside door of each switch indicating UL fuse class and size for replacement.

3.04 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
 1. Inspect mechanical and electrical connections.
 2. Verify switch and relay type and labeling verification.
 3. Verify rating of installed fuses.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- C. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches. Certify compliance with test parameters.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.6 for molded-case circuit breakers. Test all NEMA AB1, molded case circuit breakers with thermal magnetic trip or auxiliary, solid-state trip units 100A and larger. Certify compliance with test parameters.
 - a. Visual and Mechanical Inspection
 - 1) Circuit breaker shall be checked for proper mounting and compare nameplate data to Drawings and Specifications.
 - 2) Operate circuit breaker to ensure smooth operation.
 - 3) Inspect case for cracks or other defects.
 - 4) Check internals on unsealed units.
 - b. Electrical Tests
 - 1) Perform a contact resistance test.
 - 2) Perform an insulation resistance test at 1000 volts dc from pole-to-pole and from each pole-to-ground with breaker closed and across open contacts of each phase.
 - 3) Perform long time delay time-current characteristic tests by passing three hundred percent (300%) rated current through each pole separately. Record trip time. Make external adjustments as required to meet time current curves.
 - 4) Determine short time pickup and delay by primary current injection.
 - 5) Determine ground fault pickup and time delay by primary current injection.
 - 6) Determine instantaneous pickup current by primary injection using run-up or pulse method.
 - 7) Perform adjustments for final settings in accordance with coordination study.
 - 8) For circuit breakers 800A and larger, verify all functions of trip unit by means of secondary injection in lieu of primary injection.
 - c. Test Values
 - 1) Compare contact resistance or millivolt drop values to adjacent poles and similar breakers. Investigate deviations of more than fifty percent (50%). Investigate any value exceeding manufacturer's recommendations.
 - 2) Insulation resistance shall not be less than 100 megohms.
 - 3) Trip characteristic of breakers shall fall within manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 4) All trip times shall fall within N.E.T.A. Acceptance Testing Specifications, Table 10.7 Circuit breakers exceeding specified trip time at three hundred percent (300%) of pickup shall be tagged defective.
 - 5) Instantaneous pickup values shall be within values shown on N.E.T.A. Acceptance Testing Specifications, Table 10.8 or manufacturer's recommendations.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.05 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip and time delay settings to values as determined by the protective device coordination study.

3.06 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 26 28 16

SECTION 26 51 19 LED INTERIOR LIGHTING

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	1
1.04 SUBMITTALS	2
1.05 CLOSEOUT SUBMITTALS	2
1.06 MAINTENANCE MATERIAL SUBMITTALS	2
1.07 QUALITY ASSURANCE	3
1.08 DELIVERY, STORAGE, AND HANDLING	3
1.09 COORDINATION	3
1.10 WARRANTY	3
PART 2 PRODUCTS	3
2.01 LUMINAIRES (LIGHTING FIXTURES)	3
2.02 LUMINAIRE REQUIREMENTS	3
2.03 EXIT SIGNS	4
2.04 MATERIALS	4
2.05 METAL FINISHES	4
2.06 LUMINAIRE FIXTURE SUPPORT COMPONENTS	4
PART 3 EXECUTION	5
3.01 EXAMINATION	5
3.02 TEMPORARY LIGHTING	5
3.03 INSTALLATION	5
3.04 CONNECTIONS	6
3.05 IDENTIFICATION	6
3.06 FIELD QUALITY CONTROL	6
3.07 ADJUSTING	6
3.08 CLEANING	7

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Interior solid-state luminaires that use LED technology.
 - 2. Lighting fixture supports.
- B. Related Requirements:
 - 1. Section 26 09 23" Lighting Control Devices."

1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lamp: LED and substrate as a replaceable assembly.
- F. LED: Light-emitting diode.
- G. Lumen: Measured output of lamp and luminaire, or both.
- H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include emergency lighting units, including batteries and chargers.
 - 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
 - 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project per IES LM-79 and IES LM-80.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products or certified by a qualified independent testing agency.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Lighting luminaires.
 - 2. Suspended ceiling components.
 - 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
 - 4. Structural members to which equipment and luminaires will be attached.
 - 5. Initial access modules for acoustical tile, including size and locations.
 - 6. Items penetrating finished ceiling, including the following:
 - a. Other luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Ceiling-mounted projectors.
 - 7. Moldings.
- D. Qualification Data: For testing laboratory providing photometric data for luminaires.
- E. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- G. Sample warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.06 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. Light Fixtures: 10% attic stock of each type installed. Furnish at least one of each type.

1.07 QUALITY ASSURANCE

- A. Provide luminaires from a single manufacturer for each luminaire type.
- B. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with:
 1. NFPA 70 - National Electrical Code.
 2. NECA/IESNA 500-1998 – Recommended Practice for Installing Indoor Commercial Lighting Systems.
 3. NECA/IESNA 502-1999 – Recommended Practice for Installing Industrial Lighting Systems.
 4. Code of Federal Regulations (47 CFR 37342).
- E. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.09 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) or manufacturer's standard warranty length (whichever is longer) from date of Substantial Completion.

PART 2 PRODUCTS

2.01 LUMINAIRES (LIGHTING FIXTURES)

- A. Provide Luminaires as included in specification 26 5700 "Luminaire Product Data." This section contains product data sheets from the basis of design manufacturer with annotations.
- B. Acceptable alternate manufacturers are indicated on the product data sheets. Alternate manufacturer products shall be equal in all respects including materials, finishes, photometric performance and energy performance and shall include all options, features, and accessories identified.
- C. The Luminaire schedule shown on the drawings is supplemental provided for convenience and reference only. The requirements of this section and 26 5700 shall govern.

2.02 LUMINAIRE 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. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. Unless otherwise specified in Luminaire product data, provide products with a minimum CRI of 80.
- D. Unless otherwise specified in Luminaire product data, provide products with a CCT of 4100 K.

- E. Unless otherwise specified in Luminaire product data, provide products with an IES LM-80 rated lamp life of 70,000 hours.
- F. Driver
 - 1. Provided as an integrated component of the luminaire or as an external component of an assembly of luminaires.
 - 2. Nominal Input Voltage: All drivers shall be rated for use on either 120V or 277V systems.

2.03 EXIT SIGNS

- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps: Light-emitting diodes, 70,000 hours minimum of rated lamp life.
- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - 1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.04 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
 - 1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 2. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Factory-Applied Labels: Comply with UL 1598 Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI for all luminaires.

2.05 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.06 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: Unless otherwise specified in Luminaire product data, provide products with a minimum 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

- C. Wires: Unless otherwise specified in Luminaire product data, provide products with a minimum ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: Unless otherwise specified in Luminaire product data, provide products with a minimum 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

- A. Do not use permanent luminaires for temporary lighting.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and N.E.C.A./I.E.S.N.A. 500-2006 and 502-2006.
- B. Locate ceiling luminaires as indicated on reflected ceiling plan.
- C. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
 - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.
 - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- D. Support luminaires independent of ceiling framing. Support recessed grid luminaries from two opposite corners directly to structure. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- E. Install recessed luminaires to permit removal from below.
- F. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- G. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- H. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- I. Flush-Mounted Luminaire Support:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- J. Ceiling-Mounted Luminaire Support:
 - 1. Ceiling mount with two 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.

2. Ceiling mount with pendant mount with 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.
3. Ceiling mount with hook mount.
- K. Suspended Luminaire Support:
 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- L. Comply with requirements in Section 26 05 19 "Conductors and Cables" for wiring connections.

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- C. Bond products and metal accessories to branch circuit equipment grounding conductor.
- D. Connect luminaires to branch circuit outlet boxes provided under Division 26 Section "Raceways and Boxes" using 1/2" flexible conduit.

3.05 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.06 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.
- D. A visual inspection shall be performed to verify cleanliness and alignment of the fixtures, misalignment and light leaks shall be corrected, and rattles due to ventilation system vibration shall be eliminated.

3.07 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 1. During adjustment visits, inspect all luminaires. Replace lamps, drivers, or luminaires that are defective.
 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 3. Adjust the aim of luminaires in the presence of the Architect.
- B. Adjust exit sign directional arrows as indicated on Drawings.

- C. Adjust and calibrate all dimming system controls until the system works as designed. Contact the Architect/Engineer when dimming is complete and demonstrate operation to owner's representative and Architect/Engineer.

3.08 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures and lenses.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

END OF SECTION 26 51 19

Halo Commercial

DESCRIPTION

Recessed 6-inch LED lens downlight is available in various distributions, lumen and CRI/CCT options. Suitable for commercial construction and can be used for both new or renovation work. Insulation must be kept 3" from top and sides of housing. Use for general area lighting where high efficiency and visual comfort are required.

Catalog #	Type
Project	L1,L1E
Comments	Date
Prepared by	

SPECIFICATION FEATURES

MECHANICAL

Frame

Boat shaped galvanized steel frame with adjustable plaster lip accommodates ceilings up to 1/2" - 2" thick. May be used for new construction or remodeling installations. Provided with (2) remodel clips to secure frame when installed from below the ceiling.

Mounting Brackets

Bar hanger receivers adjusts 2" vertically from above the ceiling or thru the aperture. Use with No Fuss™ bar hangers or with 1/2" EMT. Removable to facilitate installation from below the ceiling.

No Fuss™ Bar Hangers

Captive preinstalled bar hanger locks to tee grid with a screwdriver or pliers. Centering mechanism allows consistent positioning of fixtures.

OPTICAL

LED Module

Proximity phosphors over chip on board LEDs provide a uniform source with high efficiency and no pixilation. Available in 80 or 90 CRI minimum, accuracy within 3 SDCM provides color uniformity. See ordering information for available CRI / CCT options. Passive thermal management achieves L70 at 50,000 hours in non IC applications. Integral diffuse lens provides visual shielding. Integral connector allows quick connection to housing flex.

Reflector

One piece parabolic aluminum reflector provides cutoff for a visually comfortable optic. Attaches to LED module with (3) speed clamps minimizing light leaks to lens. Self-flanged standard with an optional white painted flange.

Trim Retention

Reflectors are retained with two torsion springs holding the flange tightly to the finished ceiling surface.

ELECTRICAL

Junction Box

(6) 1/2" and (2) 3/4" trade size pry outs positioned to allow straight conduit runs. Listed for (12) #12 AWG (six in, six out) 90°C conductors and feed thru branch wiring.

Driver

Integral UNV 120 - 277V 50/60 Hz constant current driver provides noise free operation. For 347V input use Halo transformer H347 or H347200. Continuous, flicker-free dimming from 100% to 10% with leading or trailing edge phase cut at 120V or 0 -10V analog control.

Emergency Option

Provides 90 minutes of standby lighting meeting most life safety codes for egress lighting. Available with both integral or remote charge indicator and test switch.

Compliance

- cULus listed for wet location
- IP66 Ingress Protection Rated
- Insulation must be kept 3" from top and sides.
- Airtight per ASTM-E283.
- Optional City of Chicago environmental air (CCEA) marking for plenum applications.
- EMI/RFI emissions per FCC 47CFR Part 18 non-consumer limits.
- Contains no mercury or lead and RoHS compliant.
- Photometric testing in accordance with IES LM-79-08.
- Lumen maintenance projections in accordance with IES LM-80-08 and TM-21-11.
- Can be used to comply with California Title 24 Non-Residential Lighting Controls requirements as a LED Luminaire.
- ENERGY STAR® listed for commercial applications, reference database for current listings.



PD610
PD615
PD620
PD630

PDM6A

61V

1000, 1500,
2000 & 3000
Lumen Series

LED
6-Inch Aperture
Lens Downlight

THD: ≤ 20%
PF: ≥ 0.90
T Ambient -30 - +40°C
Sound Rating ≤ 22dba

Lumens	1000 Series	
Input Voltage	120V	277V
Input Current	.103 A	.058 A
Input Power	12.1 W	13.2 W
Efficiency	88 LPW	88 LPW
Inrush Current	0.37 A	0.77 A

Lumens	1500 Series	
Input Voltage	120V	277V
Input Current	.146 A	0.072 A
Input Power	17.1 W	17.9 W
Efficiency	87 LPW	87 LPW
Inrush Current	0.47 A	1.04 A

Lumens	2000 Series	
Input Voltage	120V	277V
Input Current	.175 A	0.086 A
Input Power	20.78 W	21.06 W
Efficiency	89 LPW	89 LPW
Inrush Current	0.54 A	1.21 A

Lumens	3000 Series	
Input Voltage	120V	277V
Input Current	.299 A	.145 A
Input Power	35.72 W	36.4 W
Efficiency	82 LPW	82 LPW
Inrush Current	0.85 A	2.0 A

Halo Commercial

Provide at "L1E"
fixtures indicated on
drawings

PD610/PD615/PD620/PD630
PDM6A
61V

ORDERING INFORMATION

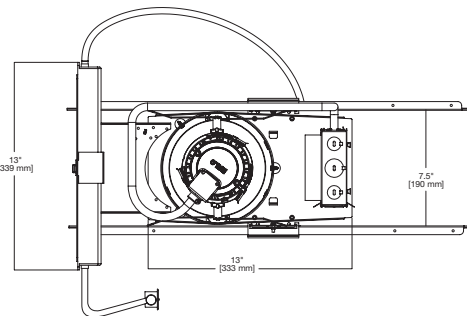
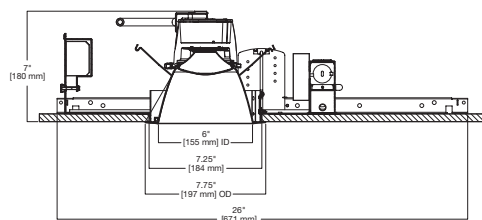
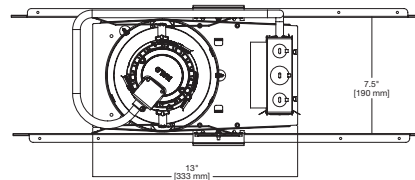
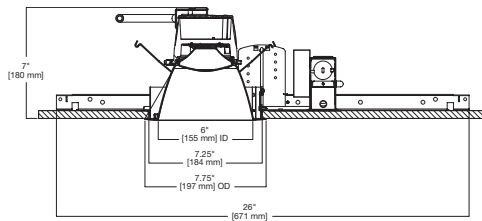
SAMPLE NUMBER: PD610ED10REM-PDM6A827-61VC

A complete luminaire consists of a housing, LED module and reflector, order separately.

Housing	Lumens	Driver	Options	LED Module	CRI/CCT
PD6 = 6" aperture LED downlight PD6CP = 6" aperture LED downlight, CCEA listed for City of Chicago plenum requirements	10 = 1,000 lumens (nominal) 15 = 1,500 lumens (nominal) 20 = 2,000 lumens (nominal) 30 = 3,000 lumens (nominal)	ED010 = 120-277V 50/60Hz, 0-10V and LE/TE phase cut dimming D010 = 120-277V 50/60Hz, 0-10V dimming (3,000 lumen only)	REM = Emergency operation with remote indicator and test switch IEM = Emergency operation with integral indicator and test switch, 60 Hz only (REM and IEM options not available with PD6CP housing)	PDM6A = Downlight LED module for PD6 housing, provides 1,000, 1,500, 2,000, or 3,000 lumens (nominal) depending on connected housing type	827 = 80 CRI, 2700K CCT 927 = 90 CRI, 2700K CCT 830 = 80 CRI, 3000K CCT 930 = 90 CRI, 3000K CCT 835 = 80 CRI, 3500K CCT 935 = 90 CRI, 3500K CCT 840 = 80 CRI, 4000K CCT 940 = 90 CRI, 4000K CCT

Reflector	Finish Option	Flange Option	Accessories
61V = 6" vertical parabolic reflector 61VEM = 6" vertical parabolic reflector for IEM	C = Specular clear G = Specular gold H = Semi-specular clear W = White (white flange) BB = Black baffle (white flange) WB = White baffle (white flange)	Blank = Polished flange standard with C, G & H reflector finishes Blank = White flange standard with W, BB, & WB WF = White flange option available with C, G, & H reflector finishes	HB128APK = L channel hanger bar, 26", 'No-Fuss', pair (replacement) RMB22 = 22" long wood joist mounting bars, pair H347 = Step down transformer for 347V input, 75VA max H347200 = Step down transformer for 347V input, 200VA max PORLWTPD1 = LumaWatt Pro Wireless Sensor Kit (0-10V only)

DIMENSIONS



Halo Commercial

PD610/PD615/PD620/PD630
PDM6A
61V

COMPLIANCE TABLE

1000 LUMEN

80 CRI																
Catalog #	PD610ED010- PDM6A827				PD610ED010- PDM6A830				PD610ED010- PDM6A835				PD610ED010- PDM6A840			
	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24
61VC	1032	77			1109	83			1177	88			1187	89		
61VCWF	1005	75			1080	81			1146	86			1156	86		
61VG	1003	75			1078	80			1144	85			1154	86		
61VGWF	966	72			1039	78			1102	82			1111	83		
61VH	924	69			993	74			1053	79			1062	79		
61VHWF	921	69			990	74			1051	78			1060	79		
61VW	960	72			1032	77			1095	82			1104	82		
61VBB	897	67			964	72			1023	76			1031	77		
61VWB	980	73			1053	79			1118	83			1127	84		

90 CRI																	
Catalog #	PD610ED010- PDM6A927				PD610ED010- PDM6A930				PD610ED010- PDM6A935				PD610ED010- PDM6A940				
	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	
61VC	795	59			853	64			917	68			1017	76			
61VCWF	775	58			831	62			894	67			990	74			
61VG	773	58			829	62			892	67			988	74			
61VGWF	745	56			799	60			859	64			952	71			
61VH	712	53			763	57			821	61			910	68			
61VHWF	710	53			761	57			819	61			908	68			
61VW	740	55			794	59			854	64			946	71			
61VBB	691	52			741	55			797	59			884	66			
61VWB	755	56			810	60			871	65			966	72			

1500 LUMEN

80 CRI																	
Catalog #	PD615ED010- PDM6A827				PD615ED010- PDM6A830				PD615ED010- PDM6A835				PD615ED010- PDM6A840				
	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	
61VC	1417	77			1523	82			1616	87			1630	88			
61VCWF	1380	75			1483	80			1574	85			1587	86			
61VG	1377	74			1480	80			1570	85			1584	86			
61VGWF	1327	72			1426	77			1513	82			1526	82			
61VH	1268	69			1363	74			1446	78			1458	79			
61VHWF	1265	68			1359	73			1442	78			1455	79			
61VW	1318	71			1417	77			1503	81			1516	82			
61VBB	1231	67			1323	72			1404	76			1416	77			
61VWB	1346	73			1446	78			1534	83			1548	84			

90 CRI																	
Catalog #	PD615ED010- PDM6A927				PD615ED010- PDM6A930				PD615ED010- PDM6A935				PD615ED010- PDM6A940				
	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	
61VC	1092	59			1171	63			1260	68			1396	75			
61VCWF	1064	57			1141	62			1227	66			1360	74			
61VG	1061	57			1138	62			1224	66			1357	73			
61VGWF	1022	55			1096	59			1179	64			1307	71			
61VH	977	53			1048	57			1127	61			1249	68			
61VHWF	975	53			1045	57			1124	61			1246	67			
61VW	1016	55			1090	59			1172	63			1299	70			
61VBB	949	51			1018	55			1095	59			1213	66			
61VWB	1037	56			1112	60			1196	65			1326	72			

ES ES = ENERGY STAR® Compliant

T24 T24 = Can be used to comply with California Title 24 Non-Residential



Halo Commercial

PD610/PD615/PD620/PD630
PDM6A
61V

COMPLIANCE TABLE continued

2000 LUMEN

80 CRI																
Catalog #	PD620ED010- PDM6A827				PD620ED010- PDM6A830				PD620ED010- PDM6A835				PD620ED010- PDM6A840			
	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24
61VC	1724	78			1853	84			1966	89			1983	90		
61VCWF	1679	76			1805	82			1915	87			1931	88		
61VG	1675	76			1801	82			1910	87			1927	88		
61VGWF	1614	73			1735	79			1841	84			1856	84		
61VH	1543	70			1658	75			1759	80			1774	81		
61VHWF	1539	70			1654	75			1755	80			1770	80		
61VW	1604	73			1724	78			1829	83			1845	84		
61VBB	1498	68			1610	73			1708	78			1723	78		
61VWB	1637	74			1759	80			1867	85			1883	86		

90 CRI																
Catalog #	PD620ED010- PDM6A927				PD620ED010- PDM6A930				PD620ED010- PDM6A935				PD620ED010- PDM6A940			
	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24
61VC	1328	60			1425	65			1532	70			1698	77		
61VCWF	1294	59			1388	63			1493	68			1654	75		
61VG	1291	59			1385	63			1489	68			1651	75		
61VGWF	1244	57			1334	61			1435	65			1590	72		
61VH	1189	54			1275	58			1371	62			1520	69		
61VHWF	1186	54			1272	58			1368	62			1516	69		
61VW	1236	56			1325	60			1426	65			1580	72		
61VBB	1154	52			1238	56			1332	61			1476	67		
61VWB	1262	57			1353	61			1455	66			1613	73		

3000 LUMEN

80 CRI																
Catalog #	PD630D010- PDM6A827				PD630D010- PDM6A830				PD630D010- PDM6A835				PD630D010- PDM6A840			
	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24
61VC	2576	72			2768	78			2937	82			2963	83		
61VCWF	2509	70			2697	76			2861	80			2886	81		
61VG	2503	70			2691	75			2855	80			2879	81		
61VGWF	2412	68			2592	73			2750	77			2774	78		
61VH	2305	65			2477	69			2629	74			2651	74		
61VHWF	2299	64			2471	69			2622	73			2645	74		
61VW	2397	67			2576	72			2733	77			2757	77		
61VBB	2238	63			2406	67			2553	72			2575	72		
61VWB	2446	69			2629	74			2790	78			2814	79		

90 CRI																	
Catalog #	PD630D010- PDM6A927				PD630D010- PDM6A930				PD630D010- PDM6A935				PD630D010- PDM6A940				
	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	LUMENS	LPW	ES	T24	
61VC	1985	56			2129	60			2290	64			2538	71			
61VCWF	1934	54			2074	58			2231	62			2472	69			
61VG	1929	54			2069	58			2226	62			2466	69			
61VGWF	1859	52			1993	56			2144	60			2376	67			
61VH	1776	50			1905	53			2049	57			2271	64			
61VHWF	1772	50			1900	53			2044	57			2265	63			
61VW	1847	52			1981	55			2131	60			2361	66			
61VBB	1725	48			1850	52			1990	56			2205	62			
61VWB	1885	53			2022	57			2175	61			2410	68			

ES

ES = ENERGY STAR® Compliant

T24

T24 = Can be used to comply with
California Title 24 Non-Residential

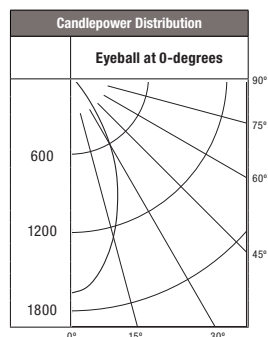


Halo Commercial

PD610/PD615/PD620/PD630
PDM6A
61V

PHOTOMETRY - 1000 lumen / 80 CRI

PD610ED010- PDM6A835-61VC
Spacing Criteria = 0.76
Lumens per Watt = 97.3 Lm/W
Test No. P137037
Test Model: PD610ED010- PDM6A835-61VC



Scaling factor for the Battery back up:

- 1000 Lumen = 0.55
- 1500 Lumen = 0.40
- 2000 Lumen = 0.33
- 3000 Lumen = 0.22

Candela Distribution	
Degrees Vertical	Candela
0°	1665
5	1614
10	1469
20	1057
30	609
40	166
50	18
60	3
70	1
80	0
90	0

*CBCP

Luminance	
(Average Candela/M²)	
Degree	Avg. 0° Luminance
45	4791
55	497
65	221
75	191
85	0

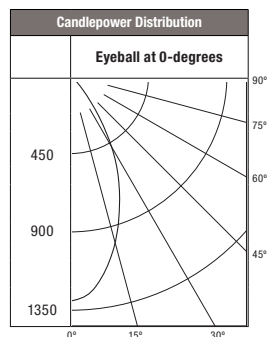
Cone of Light Footcandles			
Distance to Illuminated Plane	Initial Nadir Footcandles	Beam (ft.)	
		L Length	W Width
5.5	55.1	4	4
7	34	5.2	5.2
8	26	6	6
9	20.6	6.8	6.8
10	16.7	7.6	7.6
12	11.6	9	9

Beam diameter is to 50% of maximum footcandles, rounded to the nearest half-foot.
Footcandle values are initial, apply appropriate light loss factors where necessary.

Zonal Lumen Summary		
Zone	Lumens	% Fixture
0-30	886	75.3
0-40	1113	94.6
0-60	1175	99.8
0-90	1177	100

PHOTOMETRY - 1000 lumen / 90 CRI

PD610ED010- PDM6A935-61VC
Spacing Criteria = 0.76
Lumens per Watt = 75.8 Lm/W
Test No. P137041
Test Model: PD610ED010- PDM6A935-61VC



Scaling factor for the Battery back up:

- 1000 Lumen = 0.55
- 1500 Lumen = 0.40
- 2000 Lumen = 0.33
- 3000 Lumen = 0.22

Candela Distribution	
Degrees Vertical	Candela
0°	1298
5	1258
10	1146
20	824
30	475
40	130
50	14
60	2
70	1
80	0
90	0

*CBCP

Luminance	
(Average Candela/M²)	
Degree	Avg. 0° Luminance
45	3737
55	392
65	182
75	148
85	0

Cone of Light Footcandles			
Distance to Illuminated Plane	Initial Nadir Footcandles	Beam (ft.)	
		L Length	W Width
5.5'	52	4.4	4.4
7'	32.1	5.8	5.8
8'	24.6	6.6	6.6
9'	19.4	7.4	7.4
10'	15.7	8.2	8.2
12'	10.9	10	10

Beam diameter is to 50% of maximum footcandles, rounded to the nearest half-foot.
Footcandle values are initial, apply appropriate light loss factors where necessary.

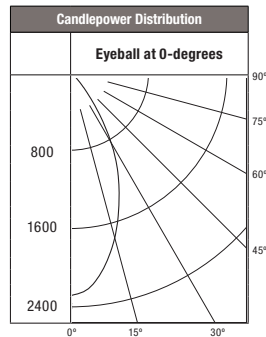
Zonal Lumen Summary		
Zone	Lumens	% Fixture
0-30	691	75.3
0-40	868	94.6
0-60	916	99.8
0-90	917	100

Halo Commercial

PD610/PD615/PD620/PD630
PDM6A
61V

PHOTOMETRY - 1500 lumen / 80 CRI

PD615ED010- PDM6A835-61VC
Spacing Criteria = 0.76
Lumens per Watt = 87.3 Lm/W
Test No. P166938
Test Model: PD615ED010- PDM6A835-61VC



Scaling factor for the Battery back up:

- 1000 Lumen = 0.55
- 1500 Lumen = 0.40
- 2000 Lumen = 0.33
- 3000 Lumen = 0.22

Candela Distribution	
Degrees Vertical	Candela
0°	2287
5	2216
10	2018
20	1452
30	836
40	228
50	25
60	4
70	1
80	0
90	0

*CBCP

Luminance	
(Average Candela/M²)	
Degree	Avg. 0° Luminance
45	6582
55	688
65	311
75	254
85	0

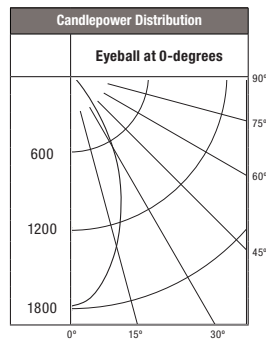
Cone of Light Footcandles			
Distance to Illuminated Plane	Initial Nadir Footcandles	Beam (ft.)	
		L Length	W Width
5.5	75.6	4	4
7	46.7	5.2	5.2
8	35.7	6	6
9	28.2	6.8	6.8
10	22.9	7.6	7.6
12	15.9	9	9

Beam diameter is to 50% of maximum footcandles, rounded to the nearest half-foot.
Footcandle values are initial, apply appropriate light loss factors where necessary.

Zonal Lumen Summary		
Zone	Lumens	% Fixture
0-30	1217	75.3
0-40	1529	94.6
0-60	1613	99.8
0-90	1616	100

PHOTOMETRY - 1500 lumen / 90 CRI

PD615ED010- PDM6A935-61VC
Spacing Criteria = 0.76
Lumens per Watt = 68.1 Lm/W
Test No. P166942
Test Model: PD615ED010- PDM6A935-61VC



Scaling factor for the Battery back up:

- 1000 Lumen = 0.55
- 1500 Lumen = 0.40
- 2000 Lumen = 0.33
- 3000 Lumen = 0.22

Candela Distribution	
Degrees Vertical	Candela
0°	1783
5	1728
10	1573
20	1132
30	652
40	178
50	20
60	3
70	1
80	0
90	0

*CBCP

Luminance	
(Average Candela/M²)	
Degree	Avg. 0° Luminance
45	5132
55	535
65	246
75	191
85	0

Cone of Light Footcandles			
Distance to Illuminated Plane	Initial Nadir Footcandles	Beam (ft.)	
		L Length	W Width
5.5	58.9	4	4
7	36.4	5.2	5.2
8	27.9	6	6
9	22	6.8	6.8
10	17.8	7.6	7.6
12	12.4	9	9

Beam diameter is to 50% of maximum footcandles, rounded to the nearest half-foot.
Footcandle values are initial, apply appropriate light loss factors where necessary.

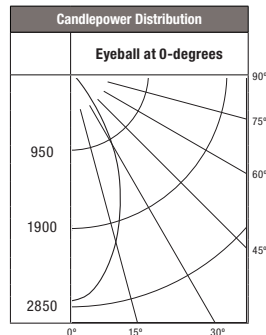
Zonal Lumen Summary		
Zone	Lumens	% Fixture
0-30	948	75.3
0-40	1192	94.6
0-60	1257	99.8
0-90	1260	100

Halo Commercial

PD610/PD615/PD620/PD630
PDM6A
61V

PHOTOMETRY - 2000 lumen / 80 CRI

PD620ED010- PDM6A835-61VC
Spacing Criteria = 0.76
Lumens per Watt = 89.4 Lm/W
Test No. P137021
Test Model: PD620ED010- PDM6A835-61VC



Scaling factor for the Battery back up:

- 1000 Lumen = 0.55
- 1500 Lumen = 0.40
- 2000 Lumen = 0.33
- 3000 Lumen = 0.22

Candela Distribution	
Degrees Vertical	Candela
0°	2782
5	2696
10	2454
20	1766
30	1017
40	278
50	31
60	4
70	2
80	0
90	0

*CBCP

Luminance	
(Average Candela/M²)	
Degree	Avg. 0° Luminance
45	8009
55	832
65	376
75	318
85	0

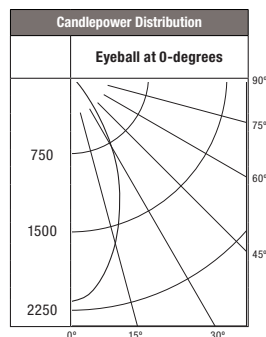
Cone of Light Footcandles			
Distance to Illuminated Plane	Initial Nadir Footcandles	Beam (ft.)	
		L Length	W Width
5.5	92	4	4
7	56.8	5.2	5.2
8	43.5	6	6
9	34.3	6.8	6.8
10	27.8	7.6	7.6
12	19.3	9	9

Beam diameter is to 50% of maximum footcandles, rounded to the nearest half-foot.
Footcandle values are initial, apply appropriate light loss factors where necessary.

Zonal Lumen Summary		
Zone	Lumens	% Fixture
0-30	1480	75.3
0-40	1860	94.6
0-60	1962	99.8
0-90	1966	100

PHOTOMETRY - 2000 lumen / 90 CRI

PD620ED010- PDM6A935-61VC
Spacing Criteria = 0.76
Lumens per Watt = 69.7 Lm/W
Test No. P137025
Test Model: PD620ED010- PDM6A935-61VC



Scaling factor for the Battery back up:

- 1000 Lumen = 0.55
- 1500 Lumen = 0.40
- 2000 Lumen = 0.33
- 3000 Lumen = 0.22

Candela Distribution	
Degrees Vertical	Candela
0°	2168
5	2102
10	1913
20	1377
30	793
40	217
50	24
60	3
70	1
80	0
90	0

*CBCP

Luminance	
(Average Candela/M²)	
Degree	Avg. 0° Luminance
45	6241
55	650
65	298
75	233
85	0

Cone of Light Footcandles			
Distance to Illuminated Plane	Initial Nadir Footcandles	Beam (ft.)	
		L Length	W Width
5.5	71.7	4	4
7	44.3	5.2	5.2
8	33.9	6	6
9	26.8	6.8	6.8
10	21.7	7.6	7.6
12	15.1	9	9

Beam diameter is to 50% of maximum footcandles, rounded to the nearest half-foot.
Footcandle values are initial, apply appropriate light loss factors where necessary.

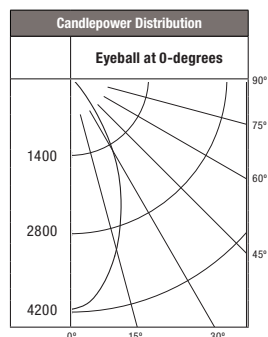
Zonal Lumen Summary		
Zone	Lumens	% Fixture
0-30	1154	75.3
0-40	1450	94.6
0-60	1530	99.8
0-90	1532	100

Halo Commercial

PD610/PD615/PD620/PD630
PDM6A
61V

PHOTOMETRY - 3000 lumen / 80 CRI

PD630ED010- PDM6A835-61VC
Spacing Criteria = 0.76
Lumens per Watt = 82.3 Lm/W
Test No. P137053
Test Model: PD630ED010- PDM6A835-61VC



Scaling factor for the Battery back up:

- 1000 Lumen = 0.55
- 1500 Lumen = 0.40
- 2000 Lumen = 0.33
- 3000 Lumen = 0.22

Candela Distribution	
Degrees Vertical	Candela
0°	4157
5	4028
10	3668
20	2639
30	1520
40	415
50	46
60	6
70	2
80	0
90	0

*CBCP

Luminance	
(Average Candela/M²)	
Degree	Avg. 0° Luminance
45	11970
55	1242
65	558
75	466
85	0

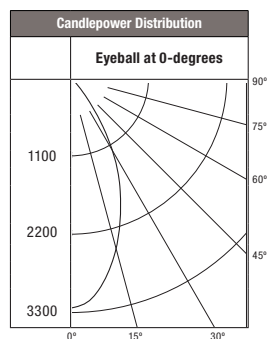
Cone of Light Footcandles			
Distance to Illuminated Plane	Initial Nadir Footcandles	Beam (ft.)	
		L Length	W Width
5.5	137.4	4	4
7	84.8	5.2	5.2
8	65	6	6
9	51.3	6.8	6.8
10	41.6	7.6	7.6
12	28.9	9	9

Beam diameter is to 50% of maximum footcandles, rounded to the nearest half-foot.
Footcandle values are initial, apply appropriate light loss factors where necessary.

Zonal Lumen Summary		
Zone	Lumens	% Fixture
0-30	2212	75.3
0-40	2779	94.6
0-60	2932	99.8
0-90	2937	100

PHOTOMETRY - 3000 lumen / 90 CRI

PD630ED010- PDM6A935-61VC
Spacing Criteria = 0.76
Lumens per Watt = 64.1 Lm/W
Test No. P137057
Test Model: PD630ED010- PDM6A935-61VC



Scaling factor for the Battery back up:

- 1000 Lumen = 0.55
- 1500 Lumen = 0.40
- 2000 Lumen = 0.33
- 3000 Lumen = 0.22

Candela Distribution	
Degrees Vertical	Candela
0°	3240
5	3140
10	2859
20	2058
30	1185
40	324
50	36
60	5
70	2
80	0
90	0

*CBCP

Luminance	
(Average Candela/M²)	
Degree	Avg. 0° Luminance
45	9327
55	975
65	441
75	360
85	0

Cone of Light Footcandles			
Distance to Illuminated Plane	Initial Nadir Footcandles	Beam (ft.)	
		L Length	W Width
5.5	107.1	4	4
7	66.1	5.2	5.2
8	50.6	6	6
9	40	6.8	6.8
10	32.4	7.6	7.6
12	22.5	9	9

Beam diameter is to 50% of maximum footcandles, rounded to the nearest half-foot.
Footcandle values are initial, apply appropriate light loss factors where necessary.

Zonal Lumen Summary		
Zone	Lumens	% Fixture
0-30	1724	75.3
0-40	2166	94.6
0-60	2286	99.8
0-90	2290	100



Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

Metalux

DESCRIPTION

Cruze LED is a premium grade specification lensed troffer series. This innovative, high quality luminaire is dedicated to the latest solid state lighting and driver technology for optimal performance and energy efficiency. The Cruze is compatible with all of today's popular ceiling systems and is available with a number of options and accessories for application versatility.

The Cruze series features efficiency, quality and performance. The series is an excellent choice for commercial office spaces, schools, hospitals or retail merchandising areas.

SPECIFICATION FEATURES

Construction

Rigid housing is die formed of code gauge prime cold rolled steel and features full length die-formed stiffeners and unibody endplate for added strength. Side flanges are hemmed. Innovative design provides superior lens brightness uniformity and visual comfort. Unibody endplates are securely attached with interlocking tabs and screws. Four auxiliary fixture end suspension points provided.

Controls

Metalux LED luminaires come standard with 0-10V dimming drivers (1% standard).

Options compatible with Eaton's Connected Lighting Systems:

- WaveLinx sensor
- LumaWatt Pro sensor
- SVPD sensor
- DLVP sensor and driver
- Fifth Light DALI driver

Other options include step-dimming and 3rd party drivers. Refer to the Connected Lighting options page and ordering information for more details.

Electrical

Long-Life LED system coupled with electrical driver to deliver optimal performance. LED's available in 3000K, 3500K, 4000K or 5000K with a minimum CRI of 80. Projected life is 60,000 hours at 79% lumen output. cULus listed. Electronic drivers are available for 120-277V and 347V applications.

Emergency Battery Pack Option

Optional 120v-277v integral emergency battery pack is available in 7-watts or 14-watts to meet critical life-safety lighting requirements. The 90-minute batteries provide constant power to the LED system, ensuring code-compliance. A test switch/indicator button can be tested safely from the ground using a laser pointer, while the patented EZ Key prevents accidental discharge of the battery during construction. Emergency/generator transfer options available – see ordering information for details.

Finish

Multistage, iron phosphate pretreatment ensures maximum bonding and rust inhibition. Housing finished with 90% reflective white enamel for superior performance.

Catalog #	Type
	L2,L2E
Project	Date
Comments	
Prepared by	

Hinging/Latching

Positive cam action steel latches with baked white enamel finish. Safety-lock T-hinges allow hinging and latching either side. Door assembly hinges down for easy access from below.

Frame/Sheilding

Die formed, heavy gauge, flat steel door with reinforced mitered corners and painted after fabrication, baked matte white enamel finish. Positive light seals. Acrylic frosted lens.

Compliance

Modules are UL recognized components and indoor luminaires are cULus listed for 25°C ambient environments, RoHS compliant, and LED modules comply with IESNA LM-79 and LM-80 standards. DesignLights Consortium® Qualified and classified for both DLC Standard and DLC Premium, refer to www.designlights.org for details.

Warranty

Five year warranty.



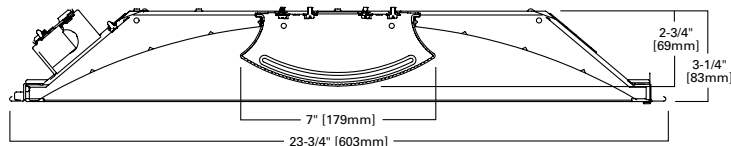
**22CZ
LED**

**2' X 2' TROFFER LED
MODULE**

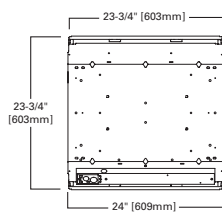
Specification Grade Troffer



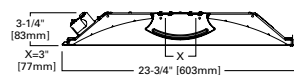
Connected Systems
[CLICK HERE](#)



MOUNTING DATA



LAMP CONFIGURATIONS



CEILING COMPATIBILITY

G	G	G	Ceiling Type	Trim Type
Grid/Lay-in Standard	Concealed T	Slot Grid	Exposed Grid	Standard
			Concealed T	Standard
			Slot Grid	Standard
			Flange	*



CERTIFICATION DATA

cULus - 1598
Damp Location Listed
IC Rated
LM79/LM80 Compliant
ROHS Compliant
DesignLights Consortium® Qualified
NOM Compliant

*See Drywall Frame Kit Accessory in Ordering Information Section

LINEAR DISCONNECT

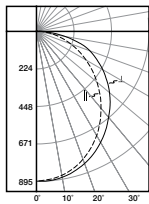
Safe and convenient means of disconnecting power



PS519141EN
May 4, 2018 3:38 PM

22CZ LED

PHOTOMETRICS



22CZ-LD5-24-UNV-L835-CD1-U
Electronic Driver
Linear LED 3500K
Spacing criterion:
(II) 1.17 x mounting
height, (L) 1.25 x
mounting height
Lumens: 2470
Input Watts: 19.6W
Efficacy: 126.0 lm/W
Test Report:
22CZ-LD5-24-UNV-
L835-CD1-U.IES

Candlepower			
Angle	Along II	45°	Across ⊥
0	893	893	893
5	884	890	892
10	866	875	879
15	838	849	857
20	799	815	829
25	753	774	793
30	701	725	750
35	641	670	703
40	577	611	651
45	511	551	602
50	445	492	548
55	379	432	490
60	313	372	434
65	249	311	374
70	186	251	315
75	126	193	231
80	74	122	140
85	30	47	46
90	0	0	0

Coefficients of Utilization

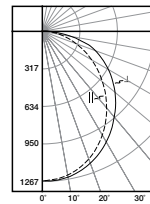
Effective floor cavity reflectance																		
rc rw RCR	80%				70%				50%				30%				10%	0%
	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	100	
1	108	104	99	95	106	101	97	94	97	94	91	93	90	88	89	87	85	
2	98	90	83	77	96	88	82	76	85	79	74	81	77	73	78	74	71	
3	90	79	71	64	87	77	70	63	74	68	62	72	66	61	69	64	60	
4	82	70	61	54	80	69	60	54	66	59	53	64	57	52	62	56	52	
5	75	62	53	47	73	61	53	46	59	52	46	57	51	45	56	50	45	
6	70	56	47	41	68	55	47	41	53	46	40	52	45	40	50	44	39	
7	65	51	42	36	63	50	42	36	49	41	36	47	40	35	46	40	35	
8	60	47	38	32	59	46	38	32	45	37	32	43	37	32	42	36	31	
9	56	43	35	29	55	42	34	29	41	34	29	40	33	29	39	33	28	
10	53	40	32	26	52	39	31	26	38	31	26	37	31	26	36	30	26	

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	680	27.5
0-40	1099	44.5
0-60	1915	77.5
0-90	2470	100.0
0-180	2470	100.0

Luminance Data

Angle in Deg	Average 0-Deg cd/sm	Average 45-Deg cd/sm	Average 90-Deg cd/sm
45	2314	2495	2726
55	2116	2412	2736
65	1897	2357	2834
75	1559	2388	2858
85	1102	1727	1690



22CZ-LD5-34-UNV-L835-CD1-U
Electronic Driver
Linear LED 3500K
Spacing criterion:
(II) 1.17 x mounting
height, (L) 1.25 x
mounting height
Lumens: 3497
Input Watts: 29.4W
Efficacy: 118.9 lm/W
Test Report:
22CZ-LD5-34-UNV-
L835-CD1-U.IES

Candlepower			
Angle	Along II	45°	Across ⊥
0	1264	1264	1264
5	1252	1260	1263
10	1226	1239	1246
15	1186	1202	1215
20	1133	1154	1173
25	1066	1095	1122
30	991	1026	1061
35	906	949	995
40	816	866	922
45	726	782	851
50	630	697	776
55	537	612	696
60	443	527	614
65	351	439	529
70	262	356	445
75	178	273	322
80	102	170	198
85	42	67	64
90	0	0	0

Coefficients of Utilization

rc rw RCR	Effective floor cavity reflectance															0%			
	80%				70%				50%				30%				10%		
	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50		30	10	
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102	100	
1	108	104	99	95	106	101	97	94	97	94	91	93	90	88	89	87	85	83	
2	98	90	83	77	96	88	82	76	85	79	74	81	77	73	78	74	71	69	
3	90	79	71	64	87	77	70	63	74	68	62	72	66	61	69	64	60	58	
4	82	70	61	54	80	69	60	54	66	59	53	64	57	52	62	56	52	49	
5	75	62	53	47	73	61	53	46	59	52	46	57	51	45	55	50	45	43	
6	70	56	47	41	68	55	47	41	53	46	40	52	45	40	50	45	39	37	
7	65	51	42	36	63	50	42	36	49	41	36	47	40	35	46	40	34	33	
8	60	47	38	32	59	46	38	32	45	37	32	43	37	32	42	36	31	30	
9	56	43	35	29	55	42	34	29	41	34	29	40	33	29	39	33	28	27	
10	53	40	32	26	52	39	31	26	38	31	26	37	31	26	36	30	26	24	

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	962	27.5
0-40	1557	44.5
0-60	2711	77.5
0-90	3497	100.0
0-180	3497	100.0

Luminance Data

Angle in Deg	Average 0-Deg cd/sm	Average 45-Deg cd/sm	Average 90-Deg cd/sm
45	3288	3542	3854
55	2998	3417	3886
65	2660	3327	4009
75	2202	3378	3984
85	1543	2462	2352

LUMEN MAINTENANCE

Ambient Temperature	TM-21 Lumen Maintenance (60,000 hours)	Theoretical L70 (Hours)
25°C	> 79%	> 178,000

90 CRI

Lumen Adjustment Factors 80->90 CRI	
3000K	0.88
3500K	0.861
4000K	0.865
5000K	0.87

Example of Lumen Adjustment Calculation

22CZ-LD5-34-UNV-L935-CD1-U
at 90CRI at 3500K

Lumen Adjustment Factor = 0.861

Total Light Output =
3,497 lm x 0.861 = 3,010 lm

Efficacy = $\frac{3,010 \text{ lm}}{29.4 \text{ W}}$ = 102.3 lm/W

ENERGY AND PERFORMANCE DATA BY CATALOG NUMBER

22CZ LED

Stock or MTO*	Catalog Logic (Ribbed Lens)	Delivered Lumens	Watts	Efficacy (lm/W)
MTO	22CZ-LD5-20-UNV-L830-CD1-U	1964	16.4	120
MTO	22CZ-LD5-20-UNV-L835-CD1-U	2086	16.4	127
MTO	22CZ-LD5-20-UNV-L840-CD1-U	2128	16.4	130
MTO	22CZ-LD5-20-UNV-L850-CD1-U	2302	16.4	141
MTO	22CZ-LD5-24-UNV-L830-CD1-U	2325	19.6	119
Stock	22CZ-LD5-24-UNV-L835-CD1-U	2470	19.6	126
Stock	22CZ-LD5-24-UNV-L840-CD1-U	2519	19.6	128
MTO	22CZ-LD5-24-UNV-L850-CD1-U	2725	19.6	139
MTO	22CZ-LD5-29-UNV-L830-CD1-U	2729	23.5	116
MTO	22CZ-LD5-29-UNV-L835-CD1-U	2899	23.5	123
MTO	22CZ-LD5-29-UNV-L840-CD1-U	2957	23.5	126
MTO	22CZ-LD5-29-UNV-L850-CD1-U	3199	23.5	136
MTO	22CZ-LD5-34-UNV-L830-CD1-U	3292	29.4	112
Stock	22CZ-LD5-34-UNV-L835-CD1-U	3497	29.4	119
Stock	22CZ-LD5-34-UNV-L840-CD1-U	3567	29.4	121
MTO	22CZ-LD5-34-UNV-L850-CD1-U	3858	29.4	131
MTO	22CZ-LD5-39-UNV-L830-CD1-U	3701	36.4	102
MTO	22CZ-LD5-39-UNV-L835-CD1-U	3932	36.4	108
MTO	22CZ-LD5-39-UNV-L840-CD1-U	4011	36.4	110
MTO	22CZ-LD5-39-UNV-L850-CD1-U	4338	36.4	119
MTO	22CZ-LD5-44-UNV-L830-CD1-U	4173	41.8	100
MTO	22CZ-LD5-44-UNV-L835-CD1-U	4433	41.8	106
MTO	22CZ-LD5-44-UNV-L840-CD1-U	4522	41.8	108
MTO	22CZ-LD5-44-UNV-L850-CD1-U	4891	41.8	117

*Made to order (MTO) requires a typical three week lead time.

Stock or MTO*	Catalog Logic (Smooth Lens)	Delivered Lumens	Watts	Efficacy (lm/W)
MTO	22CZ-LD5-20-S-UNV-L830-CD1-U	2003	16.4	122
MTO	22CZ-LD5-20-S-UNV-L835-CD1-U	2128	16.4	130
MTO	22CZ-LD5-20-S-UNV-L840-CD1-U	2170	16.4	132
MTO	22CZ-LD5-20-S-UNV-L850-CD1-U	2348	16.4	143
MTO	22CZ-LD5-24-S-UNV-L830-CD1-U	2372	19.6	121
MTO	22CZ-LD5-24-S-UNV-L835-CD1-U	2519	19.6	128
MTO	22CZ-LD5-24-S-UNV-L840-CD1-U	2570	19.6	131
MTO	22CZ-LD5-24-S-UNV-L850-CD1-U	2780	19.6	142
MTO	22CZ-LD5-29-S-UNV-L830-CD1-U	2784	23.5	118
MTO	22CZ-LD5-29-S-UNV-L835-CD1-U	2957	23.5	126
MTO	22CZ-LD5-29-S-UNV-L840-CD1-U	3016	23.5	128
MTO	22CZ-LD5-29-S-UNV-L850-CD1-U	3263	23.5	139
MTO	22CZ-LD5-34-S-UNV-L830-CD1-U	3358	29.4	114
MTO	22CZ-LD5-34-S-UNV-L835-CD1-U	3567	29.4	121
MTO	22CZ-LD5-34-S-UNV-L840-CD1-U	3638	29.4	124
MTO	22CZ-LD5-34-S-UNV-L850-CD1-U	3936	29.4	134
MTO	22CZ-LD5-39-S-UNV-L830-CD1-U	3775	36.4	104
MTO	22CZ-LD5-39-S-UNV-L835-CD1-U	4011	36.4	110
MTO	22CZ-LD5-39-S-UNV-L840-CD1-U	4091	36.4	112
MTO	22CZ-LD5-39-S-UNV-L850-CD1-U	4425	36.4	122
MTO	22CZ-LD5-44-S-UNV-L830-CD1-U	4256	41.8	102
MTO	22CZ-LD5-44-S-UNV-L835-CD1-U	4522	41.8	108
MTO	22CZ-LD5-44-S-UNV-L840-CD1-U	4612	41.8	110
MTO	22CZ-LD5-44-S-UNV-L850-CD1-U	4989	41.8	119

*Made to order (MTO) requires a typical three week lead time.

Standard Efficacy Versions

Stock or MTO*	Catalog Logic (Ribbed Lens)	Delivered Lumens	Watts	Efficacy (lm/W)
MTO	22CZ-LD5-20SE-UNV-L830-CD1-U	1948	17.2	113
STOCK	22CZ-LD5-20SE-UNV-L835-CD1-U	2069	17.2	120
STOCK	22CZ-LD5-20SE-UNV-L840-CD1-U	2110	17.2	123
MTO	22CZ-LD5-20SE-UNV-L850-CD1-U	2283	17.2	133
MTO	22CZ-LD5-24SE-UNV-L830-CD1-U	2322	21.1	110
STOCK	22CZ-LD5-24SE-UNV-L835-CD1-U	2467	21.1	117
STOCK	22CZ-LD5-24SE-UNV-L840-CD1-U	2516	21.1	119
MTO	22CZ-LD5-24SE-UNV-L850-CD1-U	2722	21.1	129
MTO	22CZ-LD5-32SE-UNV-L830-CD1-U	3015	30.5	99
STOCK	22CZ-LD5-32SE-UNV-L835-CD1-U	3203	30.5	105
STOCK	22CZ-LD5-32SE-UNV-L840-CD1-U	3267	30.5	107
MTO	22CZ-LD5-32SE-UNV-L850-CD1-U	3534	30.5	116
MTO	22CZ-LD5-39SE-UNV-L830-CD1-U	3728	34.9	107
STOCK	22CZ-LD5-39SE-UNV-L835-CD1-U	3960	34.9	114
STOCK	22CZ-LD5-39SE-UNV-L840-CD1-U	4039	34.9	116
MTO	22CZ-LD5-39SE-UNV-L850-CD1-U	4369	34.9	125
MTO	22CZ-LD5-44SE-UNV-L830-CD1-U	4118	40.0	103
STOCK	22CZ-LD5-44SE-UNV-L835-CD1-U	4375	40.0	109
STOCK	22CZ-LD5-44SE-UNV-L840-CD1-U	4463	40.0	112
MTO	22CZ-LD5-44SE-UNV-L850-CD1-U	4827	40.0	121

*Made to order (MTO) requires a typical three week lead time.

Standard Efficacy Versions

Stock or MTO*	Catalog Logic (Smooth Lens)	Delivered Lumens	Watts	Efficacy (lm/W)
MTO	22CZ-LD5-20SE-S-UNV-L830-CD1-U	1987	17.2	115
MTO	22CZ-LD5-20SE-S-UNV-L835-CD1-U	2110	17.2	123
MTO	22CZ-LD5-20SE-S-UNV-L840-CD1-U	2153	17.2	125
MTO	22CZ-LD5-20SE-S-UNV-L850-CD1-U	2328	17.2	135
MTO	22CZ-LD5-24SE-S-UNV-L830-CD1-U	2369	21.1	112
MTO	22CZ-LD5-24SE-S-UNV-L835-CD1-U	2516	21.1	119
MTO	22CZ-LD5-24SE-S-UNV-L840-CD1-U	2567	21.1	122
MTO	22CZ-LD5-24SE-S-UNV-L850-CD1-U	2776	21.1	132
MTO	22CZ-LD5-32SE-S-UNV-L830-CD1-U	3075	30.5	101
MTO	22CZ-LD5-32SE-S-UNV-L835-CD1-U	3267	30.5	107
MTO	22CZ-LD5-32SE-S-UNV-L840-CD1-U	3332	30.5	109
MTO	22CZ-LD5-32SE-S-UNV-L850-CD1-U	3605	30.5	118
MTO	22CZ-LD5-39SE-S-UNV-L830-CD1-U	3802	34.9	109
MTO	22CZ-LD5-39SE-S-UNV-L835-CD1-U	4039	34.9	116
MTO	22CZ-LD5-39SE-S-UNV-L840-CD1-U	4120	34.9	118
MTO	22CZ-LD5-39SE-S-UNV-L850-CD1-U	4457	34.9	128
MTO	22CZ-LD5-44SE-S-UNV-L830-CD1-U	4201	40.0	105
MTO	22CZ-LD5-44SE-S-UNV-L835-CD1-U	4463	40.0	112
MTO	22CZ-LD5-44SE-S-UNV-L840-CD1-U	4552	40.0	114
MTO	22CZ-LD5-44SE-S-UNV-L850-CD1-U	4924	40.0	123

*Made to order (MTO) requires a typical three week lead time.



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22CZ LED

ORDERING INFORMATION

SAMPLE NUMBER: 22CZ-LD5-34-UNV-L835-CD1-U

Rating Blank=Standard ATW-SW4=Chicago Rated	Lamp Type LD5=LED 5.0	Voltage ⁽²⁾ 347V=347 Volt ⁽²⁾ UNV=Universal Voltage 120-277 48V=48 Volt Low-voltage (Class 2) ⁽²⁾	Driver Type CD=0-10V Dimming Driver (1%-100% Dimming) ⁽²⁾ SR=Sensor-ready Dimming Driver for LWIPD1 option (1%-100% Dimming) ⁽²⁾ SLTD=Fifth Light DALI Driver (10%-100% Dimming) ⁽²⁾ SLTHD=Fifth Light Dimming Driver (1%-100% Dimming) ⁽²⁾ LV1=DLVP Dimming Driver (0%-100% Dimming) ⁽²⁾ SD=Step Dimming Driver (50% or 100% Dimming) ⁽²⁾ LH=Lutron HiLume (LDE1 series) 1%-100% EcoSystem Driver with Soft-on Fade to Black dimming ⁽²⁾ L5=Lutron 5 Series (LDE5-Series) 5%-100% EcoSystem Driver ⁽²⁾ LU=Lutron HiLume (L3D series) 1%-100% EcoSystem/3-wire Driver ⁽²⁾	Number of Drivers 1=1 Driver
Series ⁽²⁾ 22CZ=2x2 Cruze Series	Lumen Output 20=2000 Lumens 24=2400 Lumens 29=2900 Lumens 34=3400 Lumens 39=3900 Lumens 44=4400 Lumens Standard Efficacy 20SE=2000 Lumens 24SE=2400 Lumens 29SE=2900 Lumens 34SE=3400 Lumens 39SE=3900 Lumens 44SE=4400 Lumens	Options Emergency EL7W=7-watt, 120V-277V emergency battery pack installed ⁽²⁾ EL14W=14-watt 120V-277V emergency battery pack installed ⁽²⁾ ELV7W=7-watt, DLVP-compatible low voltage emergency battery pack installed ⁽²⁾ ELV14W=14-watt DLVP-compatible low voltage emergency battery pack installed ⁽²⁾ GTR2=Bodine Generator Transfer Relay ⁽²⁾ ETR2=Iota Emergency Transfer Relay ⁽²⁾ ETRD=Iota Emergency Transfer Relay with dimming control ⁽²⁾		
Door Frame Standard=Flat White Steel Door (Leave Blank)	Shielding Blank=Ribbed Frosted Acrylic Lens (standard) S=Smooth Frosted Acrylic Lens SQP=Smooth Lens with Square Pattern Insert RDP=Smooth Lens with Round Pattern Insert	CCT L830=3000K L835=3500K L840=4000K L850=5000K L930=3000K L935=3500K L940=4000K L950=5000K Flex A3/8-4/18GDIM=3/8" Flex with 0-10V Dimming Leads Multiple other configurations available. See below for details.		

Provide at "L2E" fixtures indicated on drawings

Integrated Sensing Systems
SWPD1=WaveLinX Wireless Integrated Sensor^(A)
LWIPD1=LumaWatt Pro Wireless Integrated Sensor^(B)
LWTPD1=LumaWatt Pro Wireless Tile-mount Sensor^(B)
SLVPD1=DLVP Low-voltage Integrated Sensor^(C)
SVPD1=0-10V Stand-alone Integrated Sensor^(D)

Sensor Accessories
DV=Dual Band^(E)



Connected Systems
[CLICK HERE](#)

Packaging
U=Unit Pack
PALC=Job Pack, in carton

ACCESSORIES

EQ-CLIP-U=T-BAR Safety Earthquake Clips⁽¹⁾
DF-22-W=2' x 2' Drywall Frame Kit
SK-22-WS=2' x 2' Shallow Surface Mount Kit
SK-22-WT=2' x 2' Tall Surface Mount Kit
DF10P-C=Decorator Dimmer, 0-10V (CD and HCD drivers only)
SF10P-C=Decorator Slide Dimmer, 0-10V (CD and HCD drivers only)
ISHH-01=Programming Remote for Integrated Sensor^(B)
ISHH-02=Personal Control Remote for Integrated Sensor^(B)

NOTES: ⁽¹⁾An EQ Grid Clip is recommended for all 9/16" ceiling systems. Four required per fixture. ⁽²⁾Products also available in non-US voltages and frequencies for international markets. ⁽³⁾With integral test switch/indicator/laser test. For approximate delivered lumens multiply the lumens per watt of the desired fixture by the wattage of the emergency battery pack (100 lm/W x 7=700 lumens). IES-format photometry for luminaire under emergency operation available. ⁽⁴⁾Step dim driver option is not available with 2000, 2400, 2900 and 3400 lumen packages and 2000SE, 2400SE and 3200SE versions. ⁽⁵⁾Provides blank band on opposite side from sensor band to provide symmetric appearance. ⁽⁶⁾347V versions are not available with emergency options. SD, SLTD, and SR drivers with 347V are available but not DLC qualified. ⁽⁷⁾Used to bypass local control during outage. Must be used in conjunction with UL 1008 device (provided by others). GTR2 and ETR2 options include 2 relays on fixtures with dimming drivers. ETRD option only requires one relay when used on a dimming fixture. Must specify voltage as 120V or 277V when ordering these devices. ⁽⁸⁾DesignLights Consortium® Qualified and classified for both DLC Standard and DLC Premium, refer to www.design-lights.org for details.

Integrated Sensing and Control System Options

NOTES: Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: ⁽¹⁾Consult WaveLinX system pages for additional details and compatibility. ⁽²⁾Consult LumaWatt Pro system pages for additional details and compatibility. ⁽³⁾Consult DLVP system pages for additional details and compatibility. ⁽⁴⁾Consult SVPD series system pages for additional details and compatibility. ⁽⁵⁾Consult Fifth Light system pages for additional details and compatibility. ⁽⁶⁾Consult Marketplace Options - Lutron system pages for additional details and compatibility. Compatible only with driver series shown, and may require two or more drivers. Requires field commissioning to operate or dim. Contact Lutron at www.lutron.com.

Flexible Metal Conduit Options

Flex options available for 0-10V dimming control, DALI dimming control, emergency and night light functions. 72-inch factory-installed and pre-wired to driver, fitted to luminaire housing access plate with 90° enclosed FMC connector. Not all options may be combined and installation ratings vary by type.
A3/8-4/18GDIM series notes: Factory installed dimming option 3/8" flexible metal conduit with 2-#18 power and ground wires and 2-#18 UL-listed jacketed 0-10V +/- control wires. Meets UL 66, 83, 1479, 1569, 1581, 2556. NEC® 250.118, 300.22(C), 392, 396, 330, 501, 502, 503, 530, 504, 505, 518, 520, 530, 645, 72; Federal Specification A-A-59544 (formerly J-C-30B); all applicable OSHA and HUD Requirements. UL Classified 1-, 2-, and 3-hour through penetration with applicable fire stop product (not included). May be surface mounted, fished and/or embedded in plaster. Cable tray and approved raceway rated, install per NEC®; Environmental Air-Handling Space Installation per NEC® 300.22(C).

Specifications & dimensions subject to change without notice. Consult your Eaton Representative for availability and ordering information.

SHIPPING DATA

Catalog No.	Wt.
22CZ-LD5-27	12.5 lbs.
22CZ-LD5-36	12.5 lbs.



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22CZ LED

INTEGRATED SENSOR

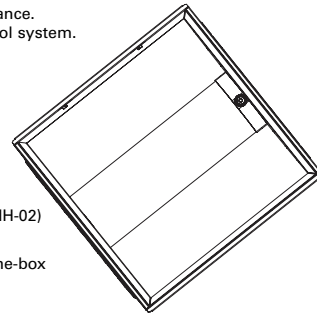
The Cruze with Integrated Sensor technology provides automatic energy savings without sacrificing performance. Traditionally, these types of energy savings required coordination between the luminaire and a lighting control system. The Cruze delivers superior lighting with integrated occupancy and daylighting controls.

Capture the benefits of traditional lighting controls, without complicated coverage planning or special wiring. Ideal for new construction or retrofit, the Cruze delivers automatic ON to an energy saving light level, while ensuring lighting is turned OFF when the space is unoccupied.

The integral daylight sensor reduces the need for special daylight zone planning. Each luminaire will automatically adjust the light level based on reflected light beneath the sensor in a closed loop method.

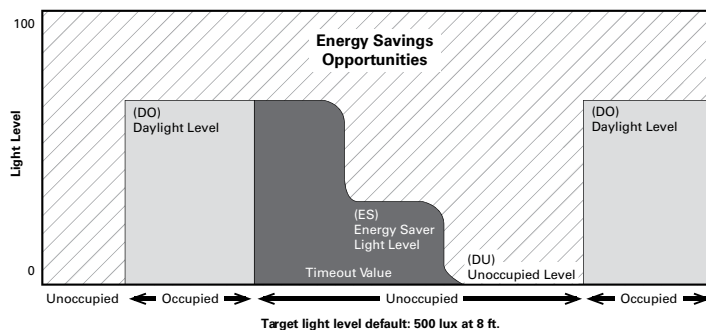
Occupied daylight light levels and unoccupied light levels can be adjusted using the integrated sensor programming remote (Catalog Number: ISHH-01). The integrated sensor personal remote (Catalog Number: ISHH-02) provides code compliant manual raise, lower, ON, OFF control.

The Cruze with Integrated Sensor is easy to install with no special wiring and ensures energy savings out-of-the-box with default control settings.

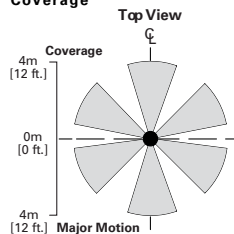


How it works:

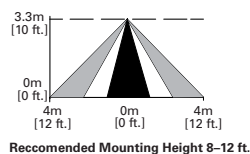
- As the user enters the space controlled by the integral sensor, the lighting turns ON to the default daylight level.
- Lighting will remain at that the daylight level until the space is unoccupied. This will start the occupancy timeout period (default 20 minutes).
- If the space remains unoccupied for half of the timeout period, the lighting will automatically reduce to the Energy Saver light level. This adjustable light level is typically half of the occupied daylight level.
- At the end of the timeout period the lighting will go to the unoccupied light level. This adjustable light level uses the OFF default setting.



Coverage



Side View



Optional Remote Controls



ISHH-01 Programming Remote



ISHH-02 Personal Control Remote



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1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

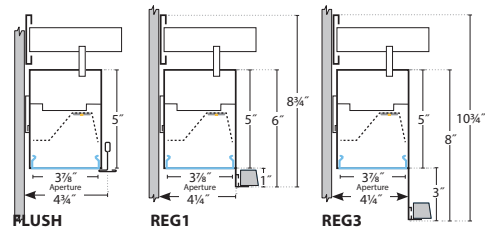
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May 4, 2018 3:38 PM

P43 | Cove & Perimeter 4" Perimeter



Type: **L3**

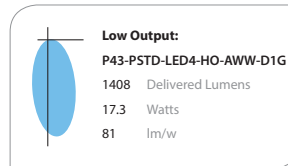
Job:



High performance wall grazer.

Optics: Glow, Wall Graze or wash a corridor in light (D1R).
Series: P43 recessed linear and Wall Wash for visual continuity.

Bionic Perimeter System contains same great optics with extruded aluminum housing to accommodate more ceiling systems.



		LO	MO	SO	HO
SAL-D1	lm/ft	390	575	755	900
	w/ft	4.5	7	10	12
AWW-D1G	lm/ft	350	550	775	900
	w/ft	4.5	7	10	12
AWL-D1R	lm/ft	390	600	875	1000
	w/ft	4.5	7	10	12



Lumen output may vary +/- 5%
4000K used for lm/ft estimates above
3500K -2% llf, 3000K -4%, 2700K -6%
-10% LLF for 90 CRI (4K, 3500K and 3K)
See LED Details PDF for more info

SERIES	LENS POSITION	LED COLOR	OUTPUT	NOMINAL LENGTH	TRIM COLOR	SHIELDING	DISTRIBUTION	MOUNTING	CIRCUITING	CEILING SYSTEMS	VOLTAGE	DRIVERS	OPTIONS, SENSORS & CORNERS
P43-PSTD													
Standard	FLSH Flush Lens REG1 1" Regress Lens REG3 3" Regress Lens	LED27 2700K (90CRI) LED3 3000K LED35 3500K LED4 4000K LED3-90 90CRI LED35-90 90CRI LED4-90 90CRI	LO Low MO Medium SO Standard HO High PROG Programmable Light Output (Specify desired lm/ft or w/ft)	2' 3' 4' 6' 7' 8' R (Row length) Any row length is achievable with field trimable filler kit NOTE: Individual not intended for row mounting	TMW Textured Matte White (Standard) YGW Gloss White Y Premium Color CC Custom Color	SAL Satin Acrylic Lens (D1 only) AWW Acrylic Wall Grazer Lens (D1G only) AWL Perimeter Fill Lens (D1R only)	D1 Direct (SAL only) D1G Wall Grazer (AWW only) D1R Perimeter Fill (AWL only, NA - REG3)	WTW Wall to Wall (Any row length) LP Light Pocket (Typically 1' increments, fixture stops before wall)	SC Single Circuit X1 T-Bar 1/2" Exposed X1M T-Bar 3/4" Exposed X2 Interlude T-Bar X6 Slot Grid X3B Hard Ceiling (Overlapping flange) X7 Hard Ceiling (Trimless mud-over concealed flange)	UNV (120-277) 347 (Emergency battery requires a Step Down transformer) LDE5 5-Series EcoSystem LED LDE1 Hi-lume 1% EcoSystem LED (Soft fade on, fade-to-black dimming) * Lutron NA with HO LTE Hi-lume 1% 2-WireLED Driver (120V forward phase only) ECO 1% 0-10v, EldoLED (Logarithmic dimming std) ECDA 1% DALI, EldoLED (Logarithmic dimming std) SOLO 0.1% 0-10v, EldoLED (Dim-to-dark, Logarithmic dimming std) SODA 0.1% DALI, EldoLED (Dim-to-dark, Logarithmic dimming std)	ND Non-Dimming DM10 0-10v, 10% Dimming (Standard) DM01 0-10v, 1% Dimming STEP Step Dimming, 100-50-Off, Osram NOTE: Lumens and watts per foot may differ for STEP drivers, consult factory LUX 205 Watt-Stopper PIR Occupancy 205-STEP: Dim to 50% 205-DM: Dim to 1%	EML Emergency Battery, Low (D1/D1R ~ 850 delivered lumens, D1G ~ 600) EMH Emergency Battery, High (D1/D1R ~ 1175 delivered lumens, D1G ~ 900) SENSORS: LUX Phillips DLH ENL Enlighted 2-Wire DLH & Environmental CORNERS: C2I Lit 90° 2-Way Inside C2O Lit 90° 2-Way Outside C2X Special Angled Connector (Consult factory)	

LED P43 | Cove & Perimeter
4" Perimeter



SAL-D1 GLOW

Low Output:

P43-PSTD-FLSH-LED4-LO-SAL-D1

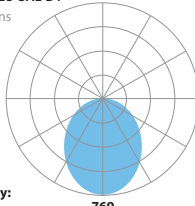
1566 Delivered Lumens

19 Watts

82 lm/w

4000 CCT

Test #L041411802



Zonal Lumen Summary:
0-90 = 100%

769

Vertical Angle	0°	25°	45°	65°	90°
0°	769	769	769	769	769
5°	762	763	763	760	760
15°	720	717	709	698	693
25°	642	632	612	592	582
35°	538	522	494	469	457
45°	421	403	373	349	337
55°	303	303	263	243	234
65°	199	188	171	157	151
75°	100	93	84	78	75
85°	24	23	21	21	20
90°	0	0	0	0	0

UPTO	88				LMW
	LO	MO	SO	HO	
lm/ft	390	575	755	900	
w/ft	4.5	7	10	12	

WALL GRAZER

Low Output:

P43-PSTD-FLSH-LED4-HO-AWW-D1G

1408 Delivered Lumens

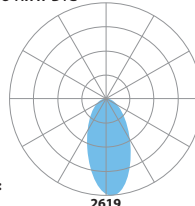
17 Watts

81 lm/w

4000 CCT

Light Labs Test

#31700



Zonal Lumen Summary:
0-90 = 100%

2619

Vertical Angle	0°	22.5°	45°	67.5°	90°
0°	2619	2619	2619	2619	2619
5°	2290	2337	2462	2578	2603
15°	1486	1526	1675	2096	2463
25°	1101	1134	1233	1588	2149
35°	787	814	898	1145	1692
45°	559	580	623	792	1141
55°	381	394	432	521	673
65°	255	260	272	311	346
75°	157	153	151	147	146
85°	54	50	47	41	32
90°	0	0	0	0	0

UPTO	81	LMW		
	LO	MO	SO	HO
lm/ft	350	550	775	900
w/ft	4.5	7	10	12

PERIMETER FILL

Low Output:

P43-PSTD-FLSH-LED4-LO-AWL-D1R

1560 Delivered Lumens

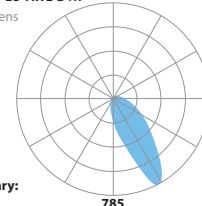
17 Watts

90 lm/w

4000 CCT

Light Labs Test

L021507501R01



Zonal Lumen Summary:
0-90 = 100%

785

Vertical Angle	0°	22.5°	45°	67.5°	90°
0°	785	785	785	785	785
5°	979	969	920	850	786
15°	1638	1548	1307	1000	763
25°	2136	2065	1742	1147	715
35°	1909	1946	1894	1253	644
45°	1358	1400	1541	1238	548
55°	863	890	991	1000	425
65°	463	491	552	597	276
75°	186	199	236	258	134
85°	39	40	45	50	26
90°	0	0	0	0	0

UPTO	88	LMW		
LO	MO	SO	HO	
lm/ft	390	600	875	1000
w/ft	4.5	7	10	12

LED P43 | Cove & Perimeter 4" Perimeter



LUMEN MAINTENANCE

Designed to last with cool running mid-power LEDs projected to maintain 90% (L90) of their initial output for 100,000 hours (at HO), and L70 exceeding 150,000 hours.

LED SYSTEM

LED modules and drivers are field replaceable.

PROG

(OPTIONAL)

Programmable light output. Specify desired lumens or watts per linear foot. Min: 2½ w/ft, consult factory for requests above 12 w/ft.

BINNING

Standard binning (all Prudential LED boards) includes testing at the chip level and board integration to provide consistent color temperature within a 3-step MacAdams ellipse, with +/- 5% lumen output range and +/- .004 Duv.

PRUBIN™

(OPTIONAL)

Prudential Ltg's exclusive 'job binning' method that ensures color temperature consistency across all luminaires on a project. Meticulously testing and labeling **EVERY LED BOARD** to +/- 25 lumens, +/- 50k CCT and +/- .004 Duv — while also separating positive from negative — allows us to match color, hue and intensity throughout a project and provides a consistent color temperature within a 2-step MacAdams ellipse.

LABELS

ETL damp labeled and I.B.E.W. manufactured.

ELECTRICAL

Must specify LED dimming controls. LED fixtures have constant current driver(s) with less than 20% THD when loaded to a minimum of 60%. Drivers sink a maximum of 6mA per driver. DM10 LED drivers are 0-10V dimmable and are compatible with most 0-10V wall slide dimmers and direct 0-10V analog signal dimmers. Max driver size 1¼" w x 1" h.

CONSTRUCTION

Housing

20-gauge steel, >20% PC recycled, 100% recyclable.

Lens

Acrylic, 100% recyclable.

X1, X2, X6 Trim

Steel.

X3, X7 Trim

Extruded aluminum.

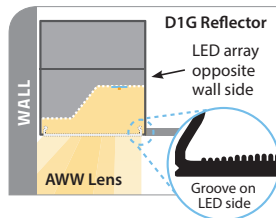
MOUNTING

Recessed into drywall or T-bar ceilings.

WARRANTY

Single-source, 5 year limited warranty covers standard components and construction.

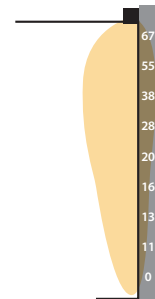
WALL GRAZER ORIENTATION



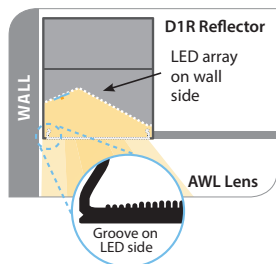
Smooth Wall Grazing.

A tight, focused beam grazes wall textures evenly, accenting and highlighting details to elevate the visual drama.

	Watts/Ft	Ceiling Height	Average Illuminance	Max	Min	Max/Min Ratio
Standard Output - 750 lm/ft	10	9'	40fc	76fc	16fc	4.75



PERIMETER FILL ORIENTATION



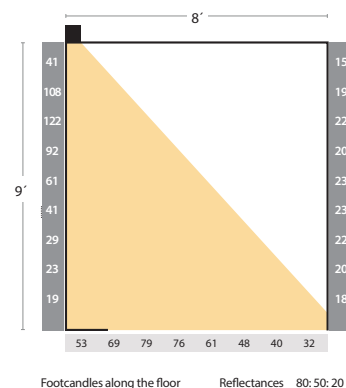
Perimeter Fill.

Fill a Corridor with Light — from the Perimeter.

It's a perimeter optic that washes corridors in light, offering outstanding light distribution, far more energy efficient than typical soft glow solutions and significantly reduces installation cost. Ideal for corridors where budget and energy efficiency conflict with strict IES requirements for high footcandles.

Suspended, surface mounted or recessed, perimeter lighting system.

	Watts/Sq. Ft.	Ceiling Height	Average Illuminance	Max/Min	Max/Min Ratio
Standard Output - 875 lm/ft	1.25	9'	57fc	79/32	2.5:1



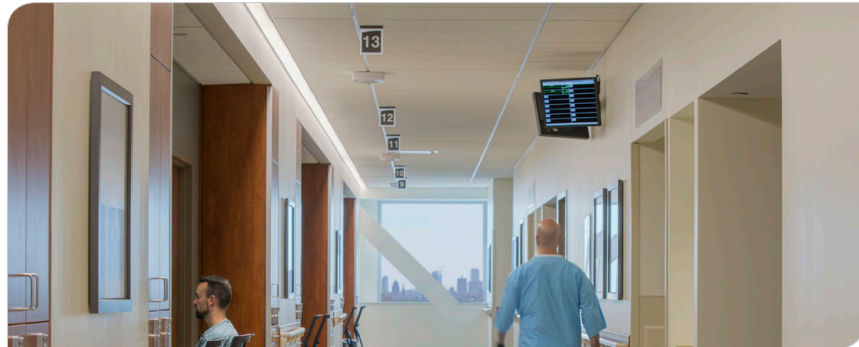
LED P43 | Cove & Perimeter
4" Perimeter



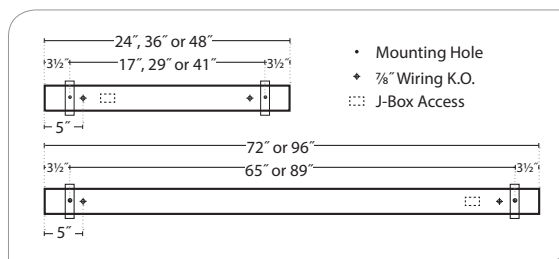
YSW - Seashell White (Matte)	YCH - Champagne (Metallic)
YSL - Silver (Metallic)	YPE - Pewter (Matte)
YRG - Rain Grey (Gloss)	YSTM - Storm Grey (Matte)
YBK - Black (Matte)	YBB - Black (Semi Gloss)
YSKM - Sky (Matte)	YMB - Military Blue (Matte)
YIB - Interstate Blue (Matte)	YSAM - Sapphire (Matte)
YFGM - Forest Green (Matte)	YBR - Bronze (Matte)
YBY - Boysenberry (Matte)	YSRM - Sunset Red (Matte)
YOR - Orange (Matte)	YDAM - Daffodil (Matte)

Choose from one of our Premium Colors with no set-up fee.

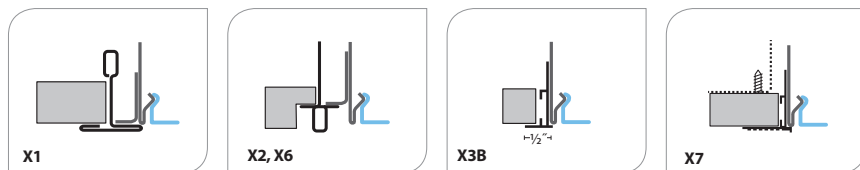
For paint chip samples, please email:
info@prulite.com



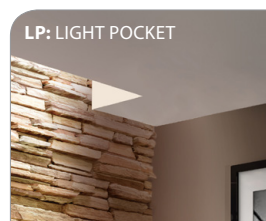
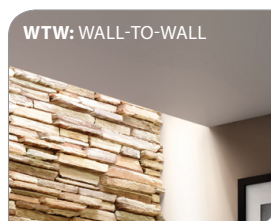
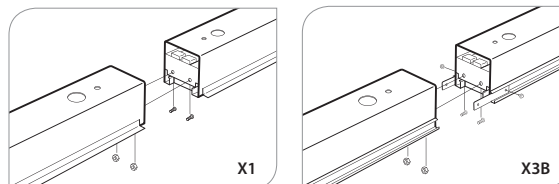
MOUNTING LOCATIONS



CEILING SYSTEMS



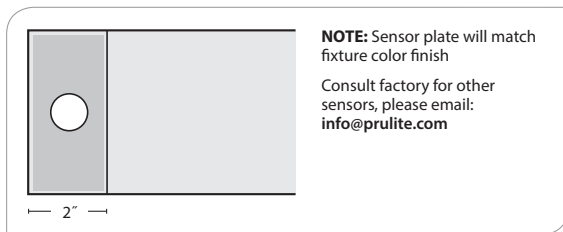
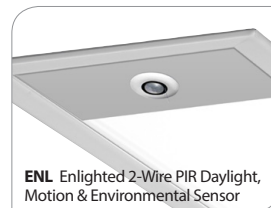
ADJOINING DETAILS



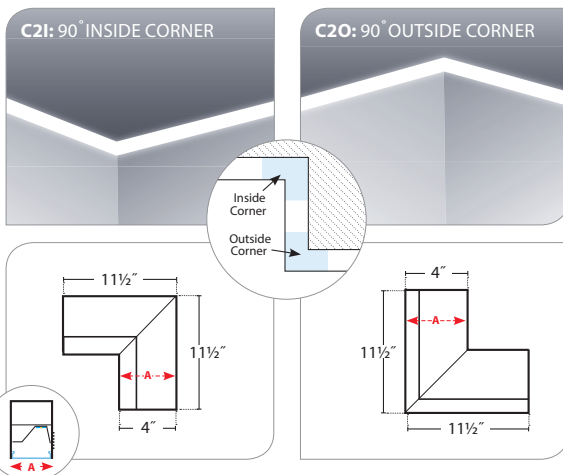
LED P43 | Cove & Perimeter
4" Perimeter



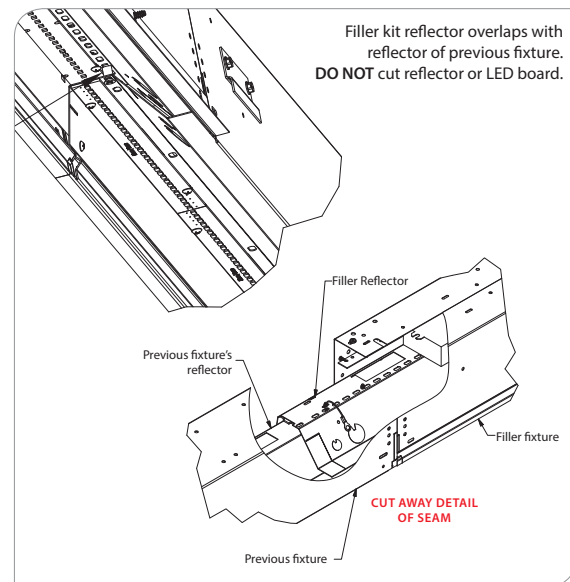
CONTROL SENSORS



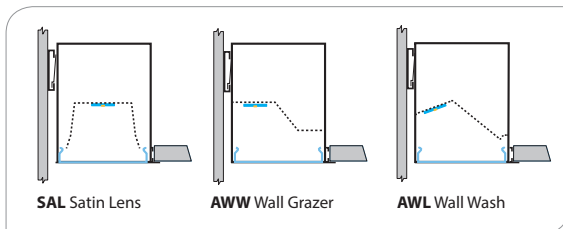
CORNERS



FIELD TRIMMABLE FILLER KIT



DISTRIBUTION CROSS SECTIONS





FEATURES & SPECIFICATIONS

INTENDED USE — Built on the compact, low-profile Z strip channel, this LED strip offers long maintenance-free life, several color temperatures, lumen outputs and lengths. Ideal for new construction and retrofit applications in T8 lengths. Ideal for use in commercial, retail, manufacturing, warehouse, and display applications. **Certain airborne contaminants can diminish the integrity of acrylic and/or polycarbonate. Click here for Acrylic-Polycarbonate Compatibility table for suitable uses.**

CONSTRUCTION — Compact-design channel and cover are formed from code-gauge cold-rolled steel. Easy to install six-point row aligner included for continuous row mounting.

Finish: Paint options include high-gloss, baked white enamel (WH), or matte black (MB). After fabrication, five-stage iron phosphate pre-treatment ensures superior paint adhesion and rust resistance.

OPTICS — Standard diffuse snap on/snap off lens eliminates pixels, improves uniformity and minimizes glare.

ELECTRICAL — Utilizes high-output LEDs integrated on a two-layer circuit board, ensuring cool-running operation. Optional internal pluggable wiring harness for reduced labor cost in row mounting applications (see PLR ordering information on page 3). Electronic LED driver is rated for 75 input watts maximum (see Operational Data on page two for actual wattage consumption), **multi-volt input and 0-10V dimming standard**. This fixture is designed to withstand a maximum line surge of 1.5kV at 0.75kA combination wave for indoor locations, for applications requiring higher level of protection additional surge protection must be provided.

LEDs provide 80CRI or 90 CRI at 3000 K, 3500 K, 4000 K or 5000 K.

Lumen output up to 1,500 lumens per foot. Luminaire should be installed in applications where ambient temperatures do not exceed 86 °F (30 °C).

INSTALLATION — Fixture may be surface mounted (with or without ZSPRG hanger), pendant or stem mounted with appropriate mounting options. Six-point aligner locks in place for easy continuous row mounting.

LISTINGS — CSA certified to US and Canadian safety standards. For use in damp locations between -4 °F (-20 °C) and 86 °F (30 °C).

DesignLights Consortium® (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

WARRANTY — 5-year limited warranty. Complete warranty terms located at www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

Note: Actual performance may differ as a result of end-user environment and application.

All values are design or typical values, measured under laboratory conditions at 25 °C.

Specifications subject to change without notice.

Catalog Number
Notes
Type L4



LED Striplight

ZL1D

24", 48" and 96" Lengths



APPROVED ALTERNATE MANUFACTURERS:
1. LA Lighting - STW100
2. Metalux - SNLED Series

Capable Luminaire

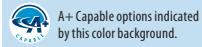
This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® or XPoint™ Wireless control networks marked by a [shaded background](#)*

To learn more about A+, visit www.acuitybrands.com/aplus.

*See ordering tree for details

ZL1D LED Striplight



ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: ZL1D L48 3000LM FST MVOLT 40K 80CRI WH

Series	Length	Reflectors ¹	Nominal lumens ²	Diffuser	Voltage	Color temperature
ZL1D LED striplight	L24 24"	SMR Symmetric	1500LM 1,500 lumens ³	FST Drop lens	MVOLT 120-277V	30K 3000 K
			2500LM 2,500 lumens ³		120 120V	35K 3500 K
			3500LM 3,500 lumens		208 208V	40K 4000 K
					240 240V	50K 5000 K
	L48 48"	ASR Asymmetric	3000LM 3,000 lumens		277 277V	
TZL1D LED striplight	L96 96"	SMR Symmetric	5000LM 5,000 lumens		347 347V ⁴	
			7000LM 7,000 lumens		480 480V ⁴	
			6000LM 6,000 lumens			
			10000LM 10,000 lumens			
			14000LM 14,000 lumens			

Color rendering index	Options	Paint finish
80CRI 80 CRI	PLR Plug-in wiring ^{5,6}	WH White
90CRI 90 CRI	PLR1LVG Plug-in wiring-low voltage ⁶	MB Matte black
	E7W Emergency battery pack ^{4,7}	GALVB Galvanized fixture with black plastic lens endcaps
	OUTEND Cord set to exit endplate of fixture	GALVW Galvanized fixture with white plastic lens endcaps
	Cord sets: ⁸	
	CS1W Straight plug, 120V	
	CS3W Twist-lock, 120V	
	CS7W Straight plug, 277V	
	CS11W Twist-lock, 277V	
	CS25W Twist-lock, 347V	
	CS97W Twist-lock, 480V	
	CS93W 600V SEOW white cord, no plug (no voltage required)	

Accessories: Order as separate catalog number.	
HC36	Hanger chain, 36"
ZACVH	Aircraft cable 10' (one pair)
ZLANGBKT	Luma-tilt™ angle bracket for shelf or ledge mounting only
NPP16D	nLight® switching/dimming module
LSXR	Sensor Switch® LSXR occupancy sensor ³
ZSPRG	For 15/16" T-grid only
WGZ24	24" wireguard, white
WGZ48	48" wireguard, white ⁷
ZLR L24 SYM UPL WH	24" symmetric reflector with uplight, white finish
ZLR L24 SYM WH	24" symmetric reflector, white finish
ZLR L46 SYM UPL WH	46" symmetric reflector with uplight, white finish
ZLR L46 SYM WH	46" symmetric reflector, white finish
ZLR L48 ASY WH	48" asymmetric reflector, white finish
ZLR L48 SYM UPL WH	48" symmetric reflector with uplight, white finish
ZLR L48 SYM WH	48" symmetric reflector, white finish
ZLR L92 SYM UPL WH	92" symmetric reflector with uplight, white finish
ZLR L92 SYM WH	92" symmetric reflector, white finish
ZLR L96 SYM UPL WH	96" symmetric reflector with uplight, white finish
ZLR L96 SYM WH	96" symmetric reflector, white finish

Notes

- Optional. Reflectors ship separately.
- See Operational Data on page 2 for actual lumens.
- Not available with 0-10V dimming option.
- Not available with L24, 24" fixture. 347V and 480V utilize a step-down transformer.
- See ordering information on page 3.
- Not available with cordsets.
- Must specify voltage. 120, 208, 240 or 277V.
- Cordsets exit back of fixture unless OUTEND option is specified.
- Order 2 for tandem double length fixtures (TZL1D).

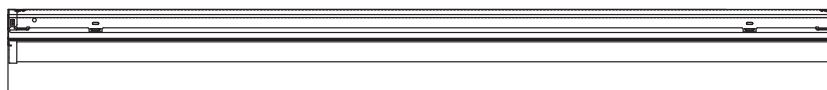
ZL1D LED Striplight

OPERATIONAL DATA												
	Nominal lumen package	Length (inches)	Delivered Lumens 3000 K CCT @ 77°F (25°C) ambient temperature		Delivered Lumens 3500 K CCT @ 77°F (25°C) ambient temperature		Delivered Lumens 4000 K CCT @ 77°F (25°C) ambient temperature		Delivered Lumens 5000 K CCT @ 77°F (25°C) ambient temperature		Wattage @ 120V/277V	Comparable Light Source
			80 CRI	90 CRI	80 CRI	90 CRI	80 CRI	90 CRI	80 CRI	90 CRI		
Lensed	1500LM	24	1985	1619	2030	1675	2061	1707	2137	1745	17	1-lamp 17W T8
	2500LM	24	2682	2187	2742	2264	2785	2307	2887	2358	22	1-lamp 17W T8
	3500LM	24	4099	3341	4190	3459	4255	3524	4412	3603	36	1-lamp 32W T8, 1-lamp 54W T5H0, 50W HID
	3000LM	48	3880	3163	3966	3274	4028	3336	4176	3410	30	1-lamp 32W T8, 1-lamp 54W T5H0, 50W HID
	5000LM	48	5337	4351	5456	4504	5541	4589	5745	4691	41	2-lamp 32W T8, 1-lamp 54W T5H0, 70W HID
	7000LM	48	7317	5965	7480	6175	7596	6291	7876	6431	59	3-lamp 32W T8, 2-lamp 54W T5H0, 100W HID
	6000LM	96	8077	6585	8257	6816	8386	6945	8694	7099	60	3-lamp 32W T8, 2-lamp 54W T5H0, 100W HID
	10000LM	96	11021	8985	11267	9301	11442	9477	11864	9687	81	4-lamp 32W T8, 2-lamp 54W T5H0, 100W HID
	14000LM	96	15397	12553	15741	12995	15986	13240	16574	13534	121	4-lamp 32W T8, 3-lamp 54W T5H0, 150W HID

DIMENSIONS

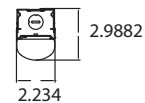
All dimensions are shown in inches (centimeters) unless otherwise noted.
Specifications subject to change without notice.

PALLET DIMENSIONS			
Length	Approximate weight	Fixtures per pallet	Approximate pallet dimensions (L x W x H)
L24	7 lbs.	176	46" X 51" X 31 5/8"
L48	13 lbs.	176	46" X 51" X 31 5/8"
L96	26 lbs.	63	46" X 98 1/2" X 31 3/8"



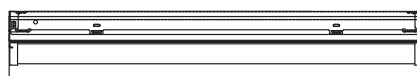
48.028

ZL1D L48



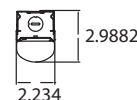
2.9882

2.234



24.028

ZL1D L24

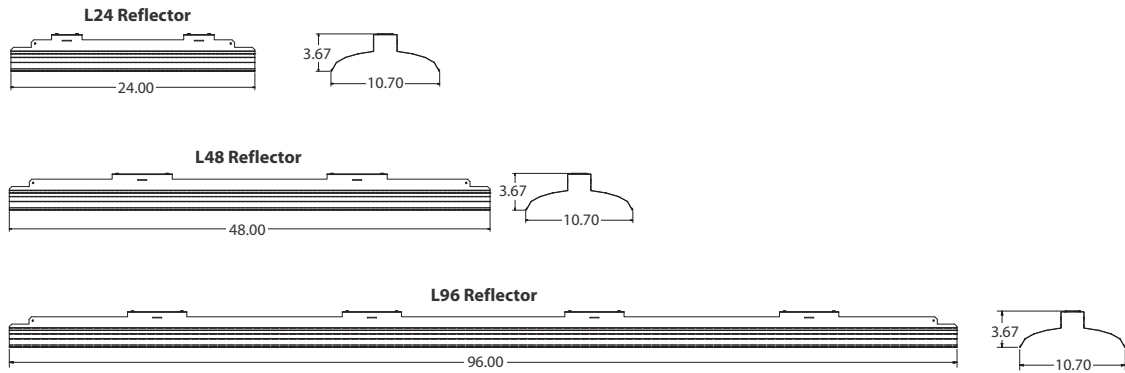


2.9882

2.234

ZL1D LED Striplight

REFLECTORS (Optional)



PHOTOMETRICS

Please see www.lithonia.com.

ZL1D LED Striplight

PRODUCT INFORMATION

Advanced plug-in system with three-circuit capability. Available on industrial and strip products and a variety of architectural products mounted in continuous rows. 1, 2, 3 and 4-lamp fixtures. PLR22 (2-circuit) and PLR33 (3-circuit) crossover harness switches hot circuit serving next fixture in row. Reduces fixture types on job for alternating circuit applications (see example below.)

Easy one-step installation, saves up to 35% on labor costs. Expanded switching flexibility helps save energy.

Rows can be 50% longer with two-circuit systems. Polarized, lock-together nylon connectors prevent miswiring in the field. #12 THHN conductor, rated 600V, 90°C. White neutral wire included. Grounding accomplished by fixture in-row connectors.

CSA certified systems available with up to 2 circuits. G ground required.

Note: Specifications subject to change without notice.



Wiring

PLR

Advanced 3-Circuit Plug-In

ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Series	Number of hot wires	Branch circuits	Dimming	Ground
PLR	(blank) Not required for 22 or 33	Circuits to which ballast is connected	LV Low-voltage dimming	(blank) No ground in PLR
PLR22	1 Black	(blank) Not required for 22 or 33		G Ground. Maximum 2 circuits
PLR33	2 Black and red	A Black wire		
	3 Black, red and blue			

Typical Applications

- Multiple-circuit and single-circuit for longer continuous rows
- Multiple-circuit with alternating fixtures on separate circuits, 2-circuit (PLR 22) and 3-circuit (PLR 33)
- Multiple circuit with night-lights located along row as desired

TYPICAL APPLICATIONS										
PLR 3 C (All PLR22)	PLR 3 C	PLR 3 C	PLR 3 C	PLR 2 B	PLR 2 B	PLR 2 B	PLR 2 B	PLR 1	PLR 1	PLR 1
Circuit A	Circuit B	Circuit A	Circuit B	Circuit A	Circuit B	Circuit A	Circuit B	Circuit A	Circuit B	Circuit A
(All PLR33)										
Circuit A	Circuit B	Circuit C	Circuit A	Circuit B	Circuit C	Circuit A	Circuit B	Circuit C	Circuit A	Circuit B
PLR 3 A	PLR 3 A	PLR 3 A	PLR 3 C	PLR 3 B	PLR 3 B	PLR 3 B	PLR 3 C	PLR 3 A	PLR 3 A	PLR 3 A

PRODUCT INFORMATION

A standard occupancy time delay is also present to ensure lights turn off (once minimum on timer has also elapsed) if no occupancy is detected.

This timer is factory set at 10 minutes to promote energy savings, but is adjustable between 30 seconds and 30 minutes. These adjustments may be done through the unit's push-button.

FEATURES

- Four interchangeable lenses - high mount 360°, low mount 360°, high mount aisleway, and small motion 360°.
- Integrated mounting bracket drops lens down 3" from chase nipple - no bracket accessory required.
- 100% digital PIR detection - provides excellent RF immunity

Note: Specifications subject to change without notice.



Passive Infrared Indoor Occupancy Sensor

LSXR

Single Relay

AcuityControls
Sensor Switch

ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: LSXR 10 ADC HVOLT 30M

LSXR											
Series		Lens option				Dimming/photocell					
LSXR	Passive Infrared Indoor Occupancy Sensor	(blank)	No lens	610	High and low mount 360°	(blank)	None				
		6	High mount, 360°	650	High mount 360° and aisleway	HL	High/low occupancy operation				
		10	Low mount, 360°	3PK	High and low mount 360° and aisleway	P	Switching photocell (on/off)				
		50	High mount aisleway	4PK	All lenses	ADC	Dimming and switching photocell				
		9	Small motion, 360°			ANL	Dimming and switching photocell with high/low occupancy operation				
Voltage		Max dim level		Min dim level		Lead length		Temp humidity		Default time delay	
(blank)	120-277 VAC (MVOLT)	(blank)	10 VDC	(blank)	Minimum dimming level of ballast	(blank)	14"	(blank)	None	(blank)	10 minutes (with minimum 15 minutes on time)
HVOLT	347-480 VAC	9H	9 VDC	1V	1 VDC	42L	42"	LT	Low temperature		
		8H	8 VDC	2V	2 VDC					5M	5 minutes (LED only)
		7H	7 VDC	3V	3 VDC					15M	15 minutes
				4V	4 VDC					20M	20 minutes
				5V	5 VDC					30M	30 minutes
		6V	6 VDC								

For additional information see www.lithonia.com

INDUSTRIAL

ZL1D
Page 5 of 6

ZL1D LED Striplight

OPTIONS AND ACCESSORIES

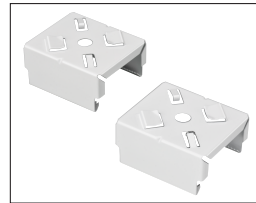
The Z Series fixture offers numerous options for almost every electrical and optical component, including a long list of field-installable accessories.



HANGER CHAIN

36" chain with Y hanger.

Order as:
HC36



Z SPRING HANGER

Snap 'n' lock design requires no fasteners and can be used on T-grid ceiling or universal mounting systems.

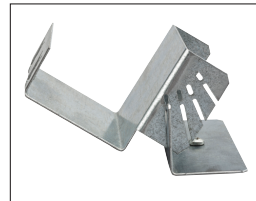
Order as:
ZSPRG



ZACVH HANGER

10' Aircraft cable with Y hanger.

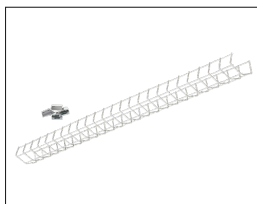
Order as:
ZACVH



ANGLE MOUNTING BRACKET

Luma-tilt™ angle bracket ships as a pair

Order as:
ZLANGBKT



WIRE GUARD

Order as:
WGZ24
WGZ48



ZL1D

Corelite

DESCRIPTION

The next generation of lighting is here with the architecturally inspired Divide™ series powered by WaveStream™ LED. The broad offering of efficient LED products include a complete family of recessed, linear suspended, surface, and wall mounted luminaires. The Divide's modern, ultra-shallow design is complemented with functionally engineered features for practical use. High performing Accu-Aim™ optics allow for maximum energy savings while achieving desired light levels. Available in 4', 8' and continuous run lengths, the Corelite Divide Suspended Series is ideal for open offices, private offices, retail, healthcare and educational facilities.

Catalog #	Type
	L5,L5E
Project	Date
Comments	
Prepared by	

SPECIFICATION FEATURES

Construction

Nominal 2-1/4" x 12" housing constructed from extruded aluminum and die-formed 20 gauge cold rolled steel. Side panel assembly measures just 3/4" tall.

End Caps

Precision engineered 2-piece die cast aluminum alloy end caps attach mechanically to the end of the fixture without exposed fasteners visible from below the fixture. End cap adds 2-1/8" at each end.

Light Engine

LED's are available in 3000K, 3500K or 4000K with CRI options of either ≥80CRI or ≥90CRI. Lumen output will be affected - please refer to the lumen adjustment factor table.

Electrical

Long-Life LED system coupled with integral electronic drivers to deliver optimal performance. Standard with 120-277V 0-10V dimming drivers (1% standard). 347V 0-10V drivers are available. Dimming wires come standard but can be capped in the field for standard switched operation.

Controls

Options compatible with Eaton's Connected Lighting Systems:

- WaveLinx sensor
- LumaWatt Pro sensor
- Fifth Light DALI driver

Refer to the Connected Lighting options page and ordering information for more details.

Mounting

Fixture mounts directly to structure over a 2"x 4" standard electrical box (by others) mounted parallel to fixture into the ceiling or wall. All sections are continuously wired with push-in connectors for fast installation. Fixtures can be joined for straight continuous runs using patented Quick-Tab alignment features. Refer to installation instructions for further installation details.

Finish

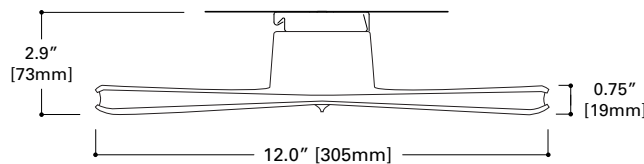
Electrostatically applied polyester powder coat paint in white, silver, or black. RAL custom colors are available.



DIVIDE - DSI WaveStream™ LED

Surface Mounted Direct / Indirect

cULus - 1598
Damp Location Listed
LM79/LM80 Compliant
ROHS Compliant
DesignLights Consortium™ Qualified



ORDERING INFORMATION

Sample Number: DSI-WS-40L835-1D-UNV-STD-SWPD1-DC-W-SU-16

Series	Shielding	Lumen Package Nominal per 4' section	Color Temperature	Number of Circuits	Additional Circuiting	Input Voltage
DSI - Divide Suspended Direct/Indirect	WS - WaveStream Specular Optic WD - WaveStream Diffuse Optic	20L - 2,000 Lms (500 lms/ft) 30L - 3,000 Lms (750 lms/ft) 40L - 4,000 Lms (1,000 lms/ft) 50L - 5,000 Lms (1,250 lms/ft) 60L - 6,000 Lms (1,500 lms/ft)	830 - 3000K, 80 CRI 835 - 3500K, 80 CRI 840 - 4000K, 80 CRI 930 - 3000K, 90 CRI 935 - 3500K, 90 CRI 940 - 4000K, 90 CRI	1 - Single Circuit	D - None (Default Dimming) E - Emergency Circuit S - Secondary Circuit N - Emergency + Secondary Circuit	120 - 120V 277 - 277V UNV - Universal (120V-277V) 347 - 347V
		Refer to performance table on Page 3 for more detail.	Additional lead-time may apply for 930, 935 and 940 configurations.	Refers to wiring in cross section.	Secondary circuit not available with integrated sensor options.	Integral 347V driver with STD 0-10V option only. Factory supplied 347V remote transformer for all other driver options.

Driver/Dimming Options	Integral Sensor	Integral Emergency	Top Cover	Finish	Mounting	Run Length
STD - Standard 0-10V (1%-100%) SR - Sensor Ready (1%-100%) 5LT - Fifth Light DALI (5%-100%) 5LTHD - Fifth Light DALI (1%-100%) LH - Lutron HiLume 1% EcoSystems L5 - Lutron 5-Series 5% EcoSystems	SWPD1 - WaveLinx Wireless Integrated Sensor LWIPD1 - LumaWatt Pro Wireless Integrated Sensor	EL14W - 14-watt, 120V-277V Emergency Battery Pack	DC - Dust Cover FC - Frosted Cover SC - Solid Cover (100% Down) (blank) - No Cover	W - White S - Silver B - Black CC - Custom Color	SU - Surface Mount - Junction Box	4 - 4 ft 8 - 8 ft XX - Specify Row Length
	SW sensor must be used with "STD" driver. LWI sensor must be used with "SR" sensor ready driver. Consult factory for emergency circuit option with integrated sensor option.				Surface mount bracket is pre-installed on luminaire. Fixture can be surface mounted to the ceiling or wall in the horizontal or vertical orientation.	Standard row configurations over 8' consist of 4' and 8' luminaires.



Provide at "L5E" fixtures indicated on drawings

PS524024EN
02/04/2019
1 of 3

SPECIFICATION FEATURES CONTINUED

DIVIDE LINEAR SURFACE - DSI

Lengths

Available in 4-ft and 8-ft sections. All sections are modular eliminating the need for starter, joiner and end sections. Standard row configurations over 8-ft consist of 4-ft and 8-ft luminaires unless otherwise specified.

Optics

Optical grade acrylic embedded with patented Accu-Aim™ micro-optics for optimal distribution, low glare, and high performance. Specular (WS) or diffuse (WD) optical patterns are available to achieve the right look for any application. See page 3 photometric data for optical performance.

Top Cover Options

Dust Cover (DC) option is a clear formed polycarbonate for worry free cleaning and protection. Frosted Cover (FC) option is a frosted formed polycarbonate for worry free cleaning, reduced uplight, and protection. Solid Cover (SC) option is a high reflectance white powder coat painted steel reflector for 100% downlight.

Lumen Maintenance

Projected lumen maintenance based on TM-21 standards is L87 > 60,000 hours at 25°C ambient conditions.

Emergency Options

Optional 120V-277V integral emergency battery pack is 14W maximum, 90 minute output, and powers a 4-foot section. Test switch/indicator button located on the side of the luminaire. Patented EZ Key prevents accidental discharge of the battery during construction. For approximate delivered lumens multiply the lumens per watt of the desired fixture by the wattage of the emergency battery pack (100 lm/W x 14 = 1400 lumens). Emergency section wiring and UL 924 emergency/generator transfer options available – consult factory for details.

Integrated Sensing and Control Systems

Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please consult WaveLinx and LumaWatt Pro system pages for

additional details and compatibility. Consult Marketplace Options - Lutron system pages for additional details and compatibility. Requires field commissioning to operate or dim. Contact Lutron at www.lutron.com.

Weight

6.0 lbs per foot.

Compliance

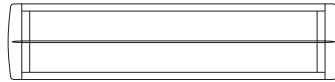
Modules are UL recognized components and indoor luminaires are cULus listed for 25°C ambient environments, damp location listed, and RoHS compliant. LED modules comply with IESNA LM-79 and LM-80 standards. DesignLights Consortium™ Qualified and classified for DLC Standard and DLC Premium, refer to www.designlights.org for details.

Warranty

Five year warranty.

FIXTURE LENGTHS

48" [1219mm]

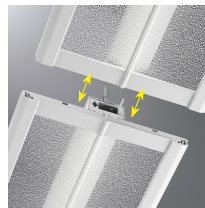


96" [2438mm]



SENSOR OPTIONS

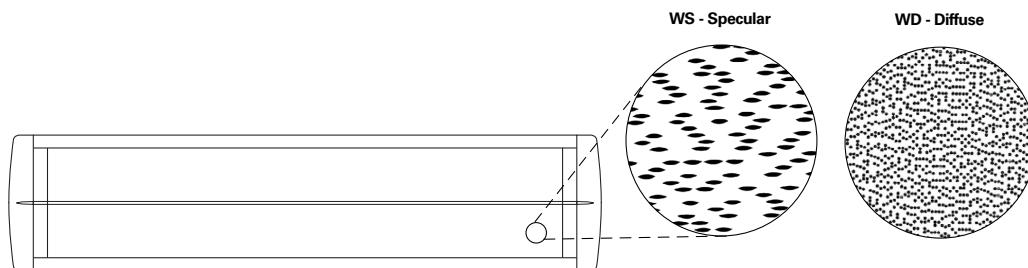
Integrated sensors are located in the endcap of 4' units and in the middle of 8' units for individual and continuous runs. Each unit is individually controllable and can be grouped together using a wireless control system.



QUICK-TAB ALIGNMENT

Corelite's patented quick-tab alignment system creates a seamless and simple installation every time. Simply align the tabs into the corresponding slots. The fixture can then hang freely while a single contractor makes the final connections; it all slides back together and is securely fastened in place.

WAVESTREAM ACCU-AIM OPTIC PATTERNS



ENERGY AND PERFORMANCE DATA

Divide Surface LED Light Level Outputs and Distributions (3500K, 80 CRI)								
Series	Lumen Package	Delivered Lumens		Wattage		Efficacy LPW	Distribution	
		4FT	Per FT	4FT	Per FT		% Up	% Down
DSI-WS	20L	2069	517	15.2	3.8	136	27%	73%
	30L	3000	750	22.4	5.6	134		
	40L	3995	999	29.9	7.5	134		
	50L	5039	1260	37.8	9.5	133		
	60L	5968	1492	46.7	11.7	128		
DSI-WD	20L	2123	531	15.2	3.8	140	29%	71%
	30L	3079	770	22.4	5.6	137		
	40L	4100	1025	29.9	7.5	137		
	50L	5172	1293	37.8	9.5	137		
	60L	6125	1531	46.7	11.7	131		

DIVIDE LINEAR SURFACE - DSI

LUMEN ADJUSTMENT FACTORS

CCT	80 CRI	90 CRI
3000K	0.955	0.830
3500K	1.000	0.861
4000K	1.012	0.883

Example Calculation:

WS / 40L / 3500K / 80 CRI

Lumen Output selected = 999 lms/ft

3500K / 90 CRI Desired

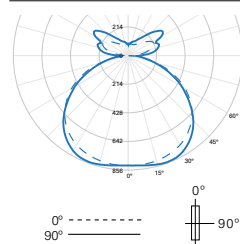
Lumen Adjustment Factor = 0.861

Adjusted Lumen Output = 999 lms/ft x 0.861 = 860 lms/ft

LUMEN MAINTENANCE

Ambient Temperature	TM-21 Lumen Maintenance (60,000 hours)	Theoretical L70 (Hours)
25°C	>87%	256,000

PHOTOMETRICS



FILE NAME: DSI-WS-40L835-1D-UNV-4.IES

LAMP: (LD2) LED 3500K

LUMENS: 3995 Lm

WATTS: 30.0 W

LPW: 133 Lm/W

TEST NO.: P35725

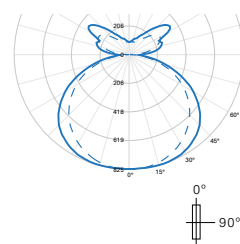
27% UP / 73% DOWN

ZONAL LUMENS SUMMARY

Zone	Lumens	% Fixture
0°-30°	697	17.4
0°-90°	2912	72.9
90°-130°	760	19.0
90°-180°	1083	27.1
0°-180°	3995	100

LUMINANCE DATA (cd/m²)

Vertical Angle	0°	45°	90°
45°	3218	3285	3304
55°	3310	3281	3193
65°	3282	3130	3027
75°	2927	2770	2718
85°	1931	2665	3167



FILE NAME: DSI-WD-40L835-1D-UNV-4.IES

LAMP: (LD2) LED 3500K

LUMENS: 4100 Lm

WATTS: 30.0 W

LPW: 137 Lm/W

TEST NO.: P213060

29% UP / 71% DOWN

ZONAL LUMENS SUMMARY

Zone	Lumens	% Fixture
0°-30°	308	16.4
0°-90°	2910	71.0
90°-130°	821	20.0
90°-180°	1190	29.0
0°-180°	4100	100

LUMINANCE DATA (cd/m²)

Vertical Angle	0°	45°	90°
45°	2928	3168	3409
55°	2956	3301	3538
65°	2965	3319	3561
75°	2868	3210	3447
85°	1954	3048	3596

COLOR DATA (3500K)

80CRI	
TM-30-15	R _f 82.3
	R _g 94.4
CRI/CIE	R _a 84.0
	R ₉ 17.2



Eaton
18001 East Colfax Avenue
Aurora, CO 80011
P: 303-393-1522
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

PS524024EN
02/04/2019
3 of 3

T 604.549.9379
F 604.549.9555
W fluxwerx.com

FLUXWERX[®]

VIEW 20 Up | 80 Dn VU1-B

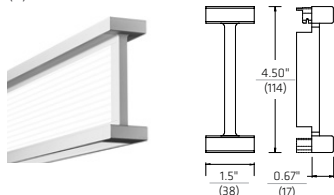
Specification Data



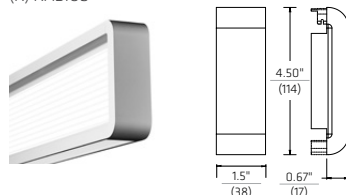
ENDCAPS + DIMENSIONS

inches
(mm)

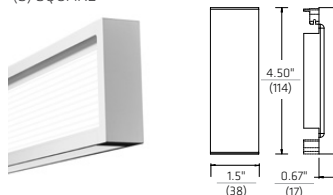
(B) BEAM



(R) RADIUS



(S) SQUARE



SPECIFICATION

VU1		B													
1	2	3	4	5	6	7	8	9	10	11	OPTIONS				
1. FAMILY		2. ENDCAP		3. OPTICAL DISTRIBUTION				4. ENERGY ¹		5. CCT		6. FINISH ²			
VU1 View		B Beam R Radius S Square		General Area Lighting		B 20 Up 80 Dn A 70 Up 30 Dn		A 19 W B 23 W C 29 W D 38 W		30 3000 K 35 3500 K 40 4000 K		A Clear Anodized B Black Powdercoat S Metallic Silver Powdercoat W White Powdercoat C Custom Colour (RAL)			
7. LENGTH		8. CEILING INTEGRATION		9. DRIVER				10. VOLTAGE		11. SUSPENSION		OPTIONS			
04 4 ft 06 6 ft 08 8 ft xx x ft ³		Integrated driver with mounting, power feed, suspension + canopy		D Drywall G Grid S Structure R Remote		E1 eldoLED ECO 0-10V Dim 1% E2 eldoLED SOLO 0-10V Dim 0.1% E3 eldoLED ECO DALI 1% E4 eldoLED SOLO DALI Dim 0.1% F1 Factory Non- Dim F2 Factory 0-10V Dim 3% F3 Factory 0-10V Dim 3% (Class 2 control wiring) ⁴ L1 Lutron Hi-Lume 1%-H EcoSystem				M 120 - 277 V 3 347 V ⁵		03 ≤ 3 ft 06 ≤ 6 ft 12 ≤ 12 ft 25 ≤ 25 ft		A Alternate Wiring - AV Presentation Switching - EM/NL or 2 circuit modules B Battery Pack ⁶ C Chicago Plenum	

NOTES

¹ Nominal values / 4 ft at 120 - 277 V & 347 V. For 347 V with E1-4/L1 add 4 W to above.

² Fixture finish only. Canopies are standard white.

³ Specify run length in 2' nominal increments.

⁴ In 347V only.

⁵ 347 V Driver for F1/F3 347 V Transformer & Driver for E1-4/L1.

⁶ Available for (G) Grid, (R) Remote and (S) Structure Available for 120 - 277V.

FLUXWERX[®]

VIEW SUSPENDED LED (VU1-B)

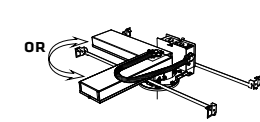
Integrated Driver, Mounting, Power Feeds + Suspension

Refer to separate product specification datasheets for detailed dimensions of mounting hardware components, driver enclosures, canopies and wiring

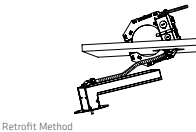
(D) DRYWALL

New or Retrofit

Integrated driver, power feed and mounting suspension points suitable for GWB or plaster thicknesses of < 0.875" (22 mm)



Perpendicular or Parallel



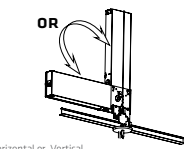
Retrofit Method

- ✓ 120-277V ✓ 347V ✗ Battery Pack
✓ 0-10V Dim ✓ Lutron ✓ eidoLED

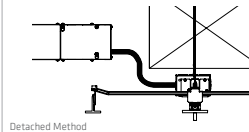
(C) GRID

ON or OFF Grid

Integrated clip, driver, power feed and mounting suspension points suitable for accessible ceiling grid heights of < 1.75" (44mm)



Horizontal or Vertical



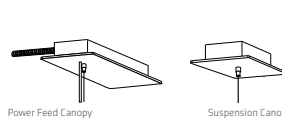
Detached Method

- ✓ 120-277V ✓ 347V ✓ Battery Pack
✓ 0-10V Dim ✓ Lutron ✓ eidoLED

(S) STRUCTURE

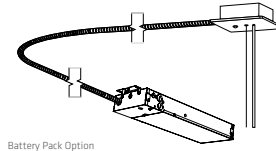
Exposed Ceilings

Integrated driver with mounting, power feed, suspension + canopy suitable for exposed surface conduit or recessed junction boxes



Power Feed Canopy

Suspension Canopy

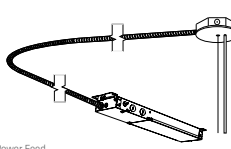


Battery Pack Option

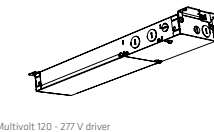
- ✓ 120-277V ✓ 347V ✓ Battery Pack
✓ 0-10V Dim ✓ Lutron ✓ eidoLED

(R) REMOTE

External remote mounted driver. Power feed and suspension points suitable for exposed conduit or recessed junction boxes



Power Feed



Multivolt 120 - 277 V driver

- ✓ 120-277V ✓ 347V ✓ Battery Pack
✓ 0-10V Dim ✓ Lutron ✓ eidoLED

Recommended Wire Gauge for Minimal Losses (AWG)

30ft. | 18 ga. 50ft. | 14 ga. 80ft. | 12 ga.

CONSTRUCTION

- Anodized, extruded + machined architectural grade aluminum
- Precision machined aluminum joints and endcaps are factory preinstalled for seamless fit
- Stainless steel fasteners
- 0.04" (1.0 mm) stainless steel aircraft cable suspensions
- Clear anodized surface finish or powdercoated in white, metallic silver or black. Canopies in white as standard

OPTICAL

- Anidolic optical structures with linear light extraction elements
- Precision molded high transmittance clear acrylic lenses
- Long life mid-flux LED system designed for typical TM21 lumen maintenance \geq L90 @ 60,000 h
- Available in 3000 K, 3500 K or 4000 K with CRI \geq 80 and R9 \geq 0, all with color accurate binning \leq 2 SDCM

ELECTRICAL

- No electrical connections are required at fixture level for installation; shipped with LV power cords factory preinstalled
- Agnostic driver design for simple integration with any sensor, lighting control or building energy management system
- High efficiency multivolt drivers for 120-277V or 347V; 50 - 60 Hz integrated with suspension and mounting canopy components
- Power Factor > 0.90
- Total Harmonic Distortion < 20%
- F2:0 - 10 V Dim Range: 3%
- Optional BatteryPack
- Optional Lutron: Hi-lume H-Series EcoSystem LED drivers for 100 - 1% (PWM) dim range

WEIGHT

- Fixture Only: ~ 1.5 lb./ft. (2.2 kg/m)

WARRANTY

- 5 year limited warranty on all components and workmanship

ENVIRONMENTAL

- Designed for use in damp or dry indoor environments with room side operating temperatures of 0 - 30° C (32 - 86° F)

INDEPENDENT TESTING

- IESNA LM79
- IESNA LM80 (LED@ 10,000 h)

APPROVALS

- UL Listed (USA + Canada)
- CCEA Chicago Plenum
- Lighting Facts[®]

FLUXWERX®

VIEW SUSPENDED LED (VU1-B)

Product	View Suspended	Description	Performance Summary		Light (lm)	Energy (W)	Efficacy (lm/W)	Color Accuracy				
Version	VU1-BA40	20 Up 80 Dn A lumens CCT 4000 K	CCT Color Temperature	4000 K	1896	18.43	102.9	83.3	6.5	< 2		
Report	FLUXWERX			3500 K	1839	18.43	99.8	83.3	6.5	< 2		
				3000 K	1781	18.43	96.7	83.3	6.5	< 2		


27.2% Up | 72.8% Dn

CANDLEPOWER DISTRIBUTION							LUMEN SUMMARY				LUMINANCE DATA (CD/M ²)			
Vertical Angle	0°	22.5°	45°	67.5°	90°	Zonal Lumens	Zone	Lumens	% Lamp	% Fixture	Vertical Angle	0°	45°	90°
0°	340	340	340	340	340	340	0-30°	301	N.A.	16	45°	5519	3179	2795
5°	336	338	339	340	344	32	0-60°	978	N.A.	52	55°	4905	2464	2141
15°	319	325	353	376	388	100	0-90°	1380	N.A.	73	65°	4264	1845	1531
25°	287	313	376	417	430	169	90-180°	516	N.A.	27	75°	3445	1283	1046
35°	244	293	369	401	413	218	Total Luminaire	0-180°	1896	100	85°	2202	848	698
45°	195	269	326	351	360	236								
55°	146	222	266	288	295	223								
65°	99	166	202	217	219	184								
75°	55	111	139	149	150	133								
85°	18	64	88	96	98	84								
90°	3	47	72	82	84									
95°	7	55	81	90	91	76								
105°	8	66	98	109	109	87								
115°	9	72	114	130	132	95								
125°	11	72	119	140	144	91								
135°	12	61	111	136	143	75								
145°	13	44	93	118	127	52								
155°	13	30	65	92	98	28								
165°	14	21	34	46	51	10								
175°	14	16	17	19	20	2								
180°	16	16	16	16	16									

CO-EFFICIENTS OF UTILIZATION														
Floor Ceiling Wall	20 50				70 50				100 50					
	70	50	30	10	70	50	30	10	100	50	30			
0	113	113	113	113	107	107	107	107	96	96	86	86	77	73
1	101	96	91	87	95	91	83	81	75	73	68	65	61	57
2	91	82	75	69	86	78	66	60	61	63	55	56	50	46
3	83	72	63	57	78	68	54	46	61	50	55	46	49	42
4	75	63	54	47	71	60	46	38	54	42	48	39	43	35
5	69	56	47	40	65	53	39	34	48	36	43	33	39	30
6	63	50	41	35	60	48	33	27	43	31	39	29	35	26
7	59	45	36	30	55	43	29	23	39	27	35	25	32	23
8	54	41	32	27	51	39	26	20	35	24	32	22	29	20
9	51	37	29	24	48	36	23	17	32	21	29	20	27	18
10	47	34	26	21	45	33	20	15	30	19	27	18	25	17

Integrating Sphere and Photometric results at 4000K, 3500K and 3000K scaled from VU1-B 38W (D) and VU1-A results from an independent accredited testing laboratory per IES LM-79-2008 and ANSI C78.377-2011. Candlepower Distribution scaled per total lumens of Integrating Sphere results.

Product	View Suspended	Description	Performance Summary		Light (lm)	Energy (W)	Efficacy (lm/W)	Color Accuracy				
Version	VU1-BB40	20 Up 80 Dn B lumens CCT 4000 K	CCT Color Temperature	4000 K	2291	22.59	101.4	83.3	6.6	< 2		
Report	FLUXWERX			3500 K	2222	22.59	98.3	83.3	6.6	< 2		
				3000 K	2153	22.59	95.3	83.3	6.6	< 2		



72.2% Up | 72.8% Dn

CANDLEPOWER DISTRIBUTION

Vertical Angle	0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	411	411	411	411	411	
5°	406	408	410	411	416	39
15°	385	392	427	454	469	121
25°	347	378	454	504	520	204
35°	295	354	446	484	499	264
45°	235	324	394	424	435	285
55°	176	268	321	348	357	269
65°	120	201	244	262	265	222
75°	67	134	167	180	182	161
85°	22	77	106	116	118	102
90°	3	57	87	99	101	
95°	8	67	98	109	110	91
105°	9	79	118	131	132	106
115°	11	87	138	157	160	115
125°	13	86	143	169	174	110
135°	14	74	135	165	173	91
145°	15	53	112	143	153	63
155°	16	36	79	111	119	34
165°	16	25	41	55	62	12
175°	16	19	21	23	24	2
180°	19	19	19	19	19	

LUMEN SUMMARY

Zone	Lumens	% Lamp	% Fixture	
0-30°	364	N.A.	16	
0-60°	1182	N.A.	52	
0-90°	1667	N.A.	73	
90-180°	624	N.A.	27	
Total Luminaire	0-180°	2291	N.A.	100

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	6667	3841	3378
55°	5929	2977	2586
65°	5153	2230	1850
75°	4164	1549	1264
85°	2659	1025	843

CO-EFFICIENTS OF UTILIZATION

Floor	20				30				10				0			
Ceiling	70	50	30	10	70	50	30	10	50	10	50	10	50	10	0	
Wall <th>80</th> <th>30</th> <th>10</th> <th></th> <th>70</th> <th>50</th> <th>30</th> <th>10</th> <th>50</th> <th>10</th> <th>50</th> <th>10</th> <th>50</th> <th>10</th> <th>0</th>	80	30	10		70	50	30	10	50	10	50	10	50	10	0	
	0	113	113	113	113	107	107	107	96	96	86	86	77	77	73	
	1	101	96	91	87	95	91	83	81	75	73	68	65	61	57	
	2	91	82	75	69	86	78	66	70	61	63	55	66	50	46	
	3	83	72	63	57	78	68	54	61	50	55	46	49	42	38	
	4	75	63	54	47	71	60	46	54	42	48	39	43	35	32	
	5	69	56	47	40	65	53	39	48	36	43	33	39	30	27	
	6	63	50	41	35	60	48	33	43	31	39	29	35	26	24	
	7	59	45	36	30	55	43	29	39	27	35	25	32	23	21	
	8	54	41	32	27	51	39	26	35	24	32	22	29	20	18	
	9	51	37	29	24	48	36	23	32	21	29	20	27	18	16	
	10	47	34	26	21	45	33	20	30	19	27	18	25	17	15	



PROJECT NAME: _____ TYPE: _____
QTY: **L7**



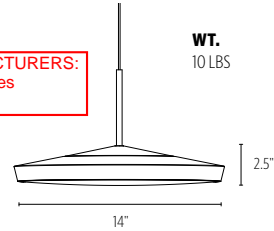
CentroTM

PENDANT

FEATURES

- DIE-CAST ALUMINUM LIGHT SOURCE ASSEMBLY
- THREAD-IN DIFFUSER
- PERFORMANCE DIFFUSER ALLOWS HIGH TRANSMISSION AND ZERO LED IMAGING
- INTEGRAL LED DRIVERS
- FIELD REPLACEABLE LIGHT SOURCE ASSEMBLY AND DRIVERS

APPROVED ALTERNATE MANUFACTURERS:
1. Evergreen Lighting - SPNAGL Series
2.



CATALOG CODES

CT1	B	14	MW	E	F	UNV	H	I	J
SERIES	HANGING SYSTEM	SIZE	DIFFUSER	FINISH	LIGHT SOURCE	VOLTAGE	OAH	CONTROL	OPTIONS

SPECIFY CATALOG CODE

A	B	C	D	E
SERIES	HANGING SYSTEM	SIZE	DIFFUSER	FINISH
 CT1 CENTRO	PICB PENDANT WITH SURFACE MOUNT CANOPY, SINGLE WHITE POWER CORD; MOUNTS TO 4X4 OCTAGON J-BOX (BY OTHERS) PICC PENDANT WITH SURFACE MOUNT CANOPY, SINGLE BLACK POWER CORD; MOUNTS TO 4X4 OCTAGON J-BOX (BY OTHERS) PICF PENDANT WITH SURFACE MOUNT CANOPY, SINGLE SILVER POWER CORD; MOUNTS TO 4X4 OCTAGON J-BOX (BY OTHERS) PIFC PENDANT WITH FLAT CANOPY, SINGLE WHITE POWER CORD; MOUNTS TO OCL RECESSED J-BOX (PROVIDED BY OCL) PIFD PENDANT WITH FLAT CANOPY, SINGLE BLACK POWER CORD; MOUNTS TO OCL RECESSED J-BOX (PROVIDED BY OCL) PIFE PENDANT WITH FLAT CANOPY, SINGLE SILVER POWER CORD; MOUNTS TO OCL RECESSED J-BOX (PROVIDED BY OCL)	14	MW MATTE WHITE	POWDER COAT FINISHES AWP AUTUMN WHITE BEP BEIGE BKP BLACK BLP BLUE BMP BRASS METALLIC BNP BRONZE BTP BLACK TEXTURED CHP COPPER HAMMERTONE CMP COPPER METALLIC DBP DENIM BLUE GRP GRAPHITE GTP GRAY TEXTURED HEP HENNA KAP KHAKI LBP LIGHT BRONZE MWP MATTE WHITE RHP RESEDA HAMMERTONE SAP SAGE GREEN SGP STEEL GRAY SHP SILVER HAMMERTONE SMP SILVER METALLIC SRP STORM GRAY SWP SKY WHITE WTP WHITE TEXTURED
F	G	H	I	J
LIGHT SOURCE	VOLTAGE	OAH	CONTROL	OPTIONS
LED OUTPUT LED1 LED2 LED3	COLOR TEMP 27K 30K 35K 40K	UNV 120-277	SPECIFY IN INCHES DM1 0-10V DIMMING 1% DM3 LUTRON HI-LUME ECOSYSTEM 1% (LDE1)	ULD DAMP LABEL MOD MODIFIED LUMINAIRE (CONTACT LOCAL REP)

SAMPLE CODE: CT1-PICB-14-MW-BKP-LED1/27K-UNV-36-DM1

MOUNT FIXTURE
SO THE BOTTOM
IS AT 6'-0" AFF.

MODS, NOTES, & COMMENTS

UP TO 110 LM/W

LUMENS AND WATTAGE CHART		SIZE
		14"
LED1	LUMENS DELIVERED	1650
	SYSTEM WATTAGE	15
LED2	LUMENS DELIVERED	2750
	SYSTEM WATTAGE	25
LED3	LUMENS DELIVERED	3850
	SYSTEM WATTAGE	35

This chart was created for a 35K color temp. Multiply by 0.95 for 27K color temp, 0.97 for 30K color temp, and 1.03 for 40K color temp.



1 of 4

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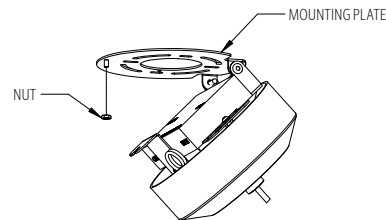
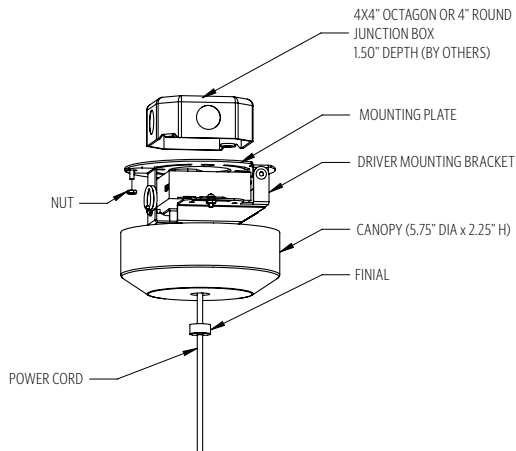
Designed and Fabricated in St. Louis, Missouri > USA

HANGING SYSTEM

- PICB** PENDANT WITH SURFACE MOUNT CANOPY, SINGLE **WHITE** POWER CORD; MOUNTS TO 4X4 OCTAGON J-BOX (BY OTHERS)
- PICC** PENDANT WITH SURFACE MOUNT CANOPY, SINGLE **BLACK** POWER CORD; MOUNTS TO 4X4 OCTAGON J-BOX (BY OTHERS)
- PICF** PENDANT WITH SURFACE MOUNT CANOPY, SINGLE **SILVER** POWER CORD; MOUNTS TO 4X4 OCTAGON J-BOX (BY OTHERS)

MOUNTING INFORMATION CHART

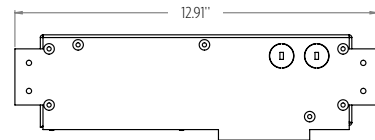
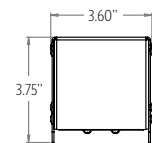
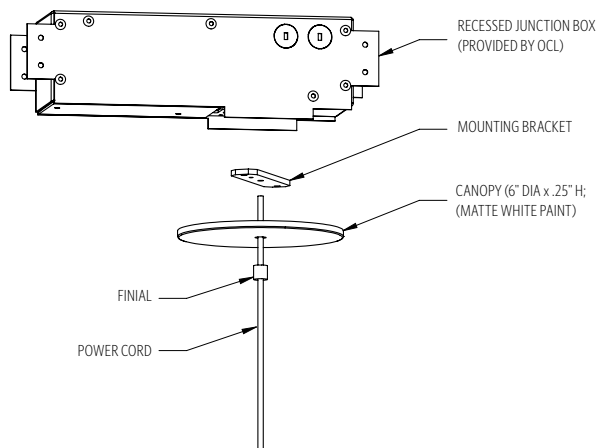
LUMINAIRE DIAMETER	LUMINAIRE WEIGHT	MIN/MAX OAH
14"	10 LBS	14"/144"



- P1FC** PENDANT WITH FLAT CANOPY, SINGLE **WHITE** POWER CORD; MOUNTS TO OCL RECESSED J-BOX (PROVIDED BY OCL)
- P1FD** PENDANT WITH FLAT CANOPY, SINGLE **BLACK** POWER CORD; MOUNTS TO OCL RECESSED J-BOX (PROVIDED BY OCL)
- P1FE** PENDANT WITH FLAT CANOPY, SINGLE **SILVER** POWER CORD; MOUNTS TO OCL RECESSED J-BOX (PROVIDED BY OCL)

MOUNTING INFORMATION CHART

LUMINAIRE DIAMETER	LUMINAIRE WEIGHT	MIN/MAX OAH
14"	10 LBS	11"/144"




























PROFILE VIEW
RECESSED JUNCTION BOX



2 of 4

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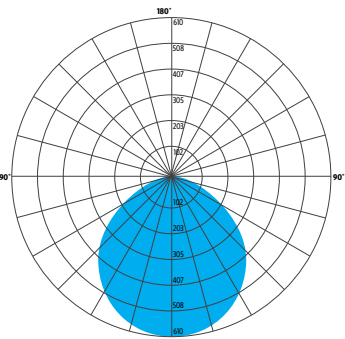
DIFFUSER		FINISH									
 MW MATTE WHITE		SOLID POWDER COAT FINISHES: <div>  SWP SKY WHITE  MWP MATTE WHITE  AWP AUTUMN WHITE  SRP STORM GRAY  KAP KHAKI  BEP BEIGE  HEP HENNA  SAP SAGE GREEN  BLP BLUE  BKP BLACK </div>									
		METALLIC POWDER COAT FINISHES: <div>  SMP SILVER  GRP GRAPHITE  SGP STEEL GRAY  BMP BRASS  LBP LIGHT BRONZE  BNP BRONZE  CMP COPPER  DBP DENIM BLUE </div>									
		TEXTURED POWDER COAT FINISHES: <div>  SHP SILVER HAMMERTONE  CHP COPPER HAMMERTONE  RHP RESEDA HAMMERTONE  BTP BLACK TEXTURED  GTP GRAY TEXTURED  WTP WHITE TEXTURED </div>									

These colors are for reference only. Please be aware that colors may vary per monitor. Please contact your sales rep for finish samples.

LIGHT SOURCE						
LUMENS AND WATTAGE CHART		STANDARD COLOR TEMPERATURE OPTIONS		LUMEN MAINTENANCE		
	SIZE		CRI	REPORTED:	L70 AT >60,000 HRS	
	14"			CALCULATED:	L70 AT 185,000 HRS	
LED1	LUMENS DELIVERED	1650	2700K	80+	REPORTED:	L90 AT 54,000 HRS
	SYSTEM WATTAGE	15	3000K	80+	CALCULATED:	L90 AT 54,000 HRS
LED2	LUMENS DELIVERED	2750	3500K	80+		
	SYSTEM WATTAGE	25	4000K	80+		
LED3	LUMENS DELIVERED	3850				
	SYSTEM WATTAGE	35				

This chart was created for a 35K color temp. Multiply by 0.95 for 27k color temp, 0.97 for 30k color temp, and 1.03 for 40k color temp.

PHOTOMETRY:
LUMINAIRE: CTI-CINA-14-GW-XXX-LED2_35K-UNV
COLOR TEMP #: 3500K
EFFICACY: 110 LM/W
TEST REPORT: TEST NO. 19811.0



ZONE	LUMENS	% OF LUMINAIRE
0-30	772	28%
0-60	2220	81%
0-90	2742	100%
90-180	0	0

Derived from EPA TM-21 calculator. Based on typical conditions. Consult the factory for additional details

CONTROL	
DM1 0-10V DIMMING 1% <ul style="list-style-type: none"> 0-10V DIMMING 1% MINIMUM DIM LEVEL ELECTRONIC DRIVER POWER FACTOR >0.9 THD <20% MINIMUM AMBIENT OPERATING TEMPERATURE -22°F FIELD REPLACEABLE 	DM3 LUTRON HI-LUME ECOSYSTEM 1% <ul style="list-style-type: none"> LUTRON HI-LUME SOFT-ON, FADE-TO-BLACK 1%, ECOSYSTEM, LDE1 ELECTRONIC DRIVER POWER FACTOR >0.9 THD <20% MINIMUM AMBIENT OPERATING TEMPERATURE -32°F FIELD REPLACEABLE

OPTIONS

ULD DAMP LABEL LUMINAIRE

- MAY BE USED IN A OUTDOOR AREA THAT IS PROTECTED FROM DIRECT CONTACT WITH WIND, RAIN, SNOW OR EXCESSIVE MOISTURE

MOD MODIFIED LUMINAIRE

- LUMINAIRE IS MODIFIED FROM STANDARD OPTIONS. CONTACT LOCAL REP FOR MORE INFORMATION

SPECIFICATIONS

CONSTRUCTION

- HOUSING IS DIE-CAST ALUMINUM
- DIFFUSER IS INJECTION-MOLDED WITH FROSTED SURFACE
- CANOPY IS SPUN ALUMINUM
- HARDWARE IS ZINC PLATED OR STAINLESS STEEL

MOUNTING

- PICB, PICC, PICF ALL MOUNT TO 4X4" OCTAGON OR 4" ROUND J-BOX (BY OTHER)
- PIFC, PIFD, PIFE ALL MOUNT TO OCL PROPRIETARY RECESSED J-BOX (PROVIDED BY OCL)

ELECTRICAL

- DIMMING ELECTRONIC DRIVER(S) COMES STANDARD WITH 0-10V DOWN TO 1%
- LUTRON (LDEI) ECOSYSTEM 1% ALSO AVAILABLE
- OCL PROPRIETARY LED ARRAYS USE NICHIA 757 DIODES
- **FOR INTEGRAL DRIVERS:** LUMINAIRE CONNECTS TO BUILDING SUPPLY (120V-277V 50/60HZ)
- **FOR REMOTE DRIVERS:** LUMINAIRE WIRE LEADS ARE LOW-VOLTAGE. THE WIRES SHOULD BE CONNECTED TO OCL PROVIDED REMOTE DRIVER ENCLOSURE ONLY!

LISTING

- ETL LISTED TO UL 1598 FOR DRY LOCATIONS, DAMP LOCATION LISTED IS OPTION

WARRANTY

- 5 YEAR; ALL ELECTRICAL COMPONENTS RETAIN THE MANUFACTURER'S WARRANTY


Type
L8




Cat. No.

Project:

Notes:

LLP4-LLPRM4





**LOW PROFILE 4" APERTURE
UP TO 4800 LUMENS DELIVERED
LLP4/LLPRM4 SERIES**


A+ Capable options indicated
by this color background

Extreme Low Profile with No Compromises

- 3000 lumens delivered with as low as 2" plenum space*
- 4800 lumens delivered with as low as 3" plenum space*
- Maintains same 45° cut-off as the standard L-Series fixtures
- Hyperbolic, Parabolic, and Wall Washer (single, double and corner) distributions
- New Construction, Remodel, and Chicago Plenum versions
- Chicago Plenum is IC rated for 08LM – 23LM
- Flanged and flangeless

APPROVED ALTERNATE MANUFACTURERS:
1. Edison Price Lighting - WAFER/4 DL Series
2. Alphabet Lighting - NU4 Series


NEW CONSTRUCTION **REMODEL** **As low as 2" ***

* Fixture height may vary. See dimensional drawings for details.

ORDERING INFORMATION - COMPLETE FIXTURE

Complete Fixture Catalog# Example: LLP4 08LM 35K MVOLT G4 80CRI ZT HM CD HBTL

Series	Light Engine	CCT	Voltage	Gen	CRI	Driver	Rough-In Options
LLP4	4" L-Series Low Profile New Construction Downlight	08LM 13LM 15LM 17LM 23LM 28LM 33LM 40LM 45LM	27K 30K 35K 40K 50K	120 277 347 MVOLT (120-277)	G4	80CRI 90CRI 97CRI ¹	F ^{2,6} Fuse and Fuse Holder CP ^{7,12,14} Chicago Plenum LDI Lumen Depreciation Indicator BR ^{2,12} Emergency Battery Pack BRT20C ^{2,12} Emergency Battery Pack, Title 20 Compliant HBR ^{2,12} High Lumen Emergency Battery Pack HBRT20C ^{2,12} High Lumen Emergency Battery Pack, Title 20 Compliant NL ^{6,15} nLight® Dimming Pack Controls NLER ^{6,15} nLight® dimming pack controls. nLER controls fixtures on emergency circuit NLTAIR2 ^{2,13} nLight® AIR Dimming Pack Wireless Controls NLTAIRER2 ^{2,13} nLight® AIR Dimming Pack Wireless Controls. Controls fixtures on emergency circuit
LLPRM4 ^{2,9,15}	4" L-Series Low Profile Remodel Downlight					EDAB ^{3,4} eldoLED SOLOdrive DALL Logarithmic dimming to <1% EZ10 ⁸ eldoLED 0-10V ECOdrive. Linear dimming to 10% min. EZ13 ⁸ eldoLED 0-10V ECOdrive. Linear dimming to 1% min. EZB ³ eldoLED 0-10V SOLOdrive. Logarithmic dimming to <1% FD ^{4,5} Forward or Reverse Phase Dimming Driver ECOD ¹⁷ Lutron Ecosystem Dimming Driver FDL ¹⁸ Forward Phase Dimming Lutron Driver GZ1 0-10V Dimming to 1% min ZT 0-10V Dimming to 10% min	

Trim Style	Finish	Trim Options	Mounting
HM Hyperbolic Medium	BD Black Diffuse	GD Gold Diffuse	Blank Flanged
HN Hyperbolic Narrow	BS Black Specular	GS Gold Specular	FM ⁹ Flangeless
HW Hyperbolic Wide	BZD Bronze Diffuse	PTD Pewter Diffuse	
HWS Hyperbolic Single Wall Wash	BZS Bronze Specular	PTS Pewter Specular	
P Parabolic Medium	CD Clear Diffuse	VH White, White Flange	
	CS Clear Specular	WTD Wheat Diffuse	
	CSS Clear Semi-Specular	WTS Wheat Specular	

Accessories ¹²
IFMA4 ^{10,12} 4" Flangeless Adapter for Drywall Ceilings
HB28 ¹² 28" C-Channel Bar Hangers, Pair
HB52 ¹² 52" C-Channel Bar Hangers, Pair
HBTL ¹² 25" Tru-Lock Grid Ceiling Bar Hanger, Pair
LB27 ¹² 27" Linear Bar Hangers, Pair

Ordering Notes

- 1 2700K & 3000K only.
- 2 Not available with 347V.
- 3 Not compatible with LDI.
- 4 Not available for NL, NLER, NLTAIR2, NLTAIRER2.
- 5 120V only. Not available with 40LM.
- 6 Specify voltage.
- 7 Not compatible with BR, BRT20C, HBR, HBRT20C.
- 8 Compatible with Parabolic trim styles only.
- 9 Not compatible with FM.
- 10 IFMA4 required for FM.
- 11 Not required when specifying WH finish.
- 12 Not compatible with LLPRM4.

- 13 Not recommended for metal ceilings.
- 14 For 28LM - 45LM, specify voltage. Not available with ZT or GZ1 for 40LM and 45LM.
- 15 LLPRM4 with NL or NLER options must be ordered with EZ1, EZB, or EZ10 drivers.
- 16 NPR, WPR available with CS, CSS, CD, VH finishes only.
- 17 Not compatible with LLPRM4 at 45LM. Not compatible with CP for 28LM and up.
- 18 120V only. Not compatible for 28LM and up. Not compatible with LLPRM4 for 23LM and up. Not compatible with CP.

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1 of 12

LUMINAIRE PRODUCT DATA SHEETS

26 57 00 - 36

LLP4-LLPRM4

PERFORMANCE

LIGHT ENGINE	08LM		13LM		15LM		17LM		23LM		28LM		33LM		40LM		45LM	
VOLTAGE	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V
INPUT WATTS	7.5	7.9	11.7	11.8	13.7	13.8	17.8	17.9	23.5	23.7	28.5	28.2	33.6	33.8	42.1	41.7	41.4	41.7
INPUT CURRENT	0.06	0.31	0.10	0.05	0.12	0.06	0.15	0.07	0.20	0.09	0.24	0.11	0.28	0.13	0.35	0.16	0.35	0.16
POWER FACTOR	0.99	0.90	0.99	0.89	0.99	0.89	0.99	0.91	0.99	0.92	1.00	0.94	1.00	0.93	1.00	0.95	1.00	0.93
THD %	6.4	12.0	5.2	11.6	4.6	11.3	3.9	11.3	5.1	9.9	5.5	9.0	4.4	10.5	4.5	8.8	6.0	9.2
HYPERBOLIC REFLECTOR: LLP4 HW CS (35K 80CRI)																		
DELIVERED LUMENS (LLP4 HW CS)	866		1,445		1,670		1,901		2,559		3,086		3,591		4,366		4,879	
EFFICACY (LPW)	115		123		122		107		109		108		107		104		118	
PARABOLIC REFLECTOR: LLP4 P CS (35K 80CRI)																		
DELIVERED LUMENS (LLP4 P CS)	658		1,097		1,268		1,444		1,943		2,343		2,727		3,315		3,705	
EFFICACY (LPW)	87		94		93		81		83		82		81		79		90	

OPTICAL DISTRIBUTIONS

HYPERBOLIC BEAM SPREAD		
Trim	08LM - 40LM	40LM - 45LM
LLP4 HN CS	18°	30°
LLP4 HN CSS	18°	30°
LLP4 HN CD	30°	47°
LLP4 HM CS	37°	52°
LLP4 HM CSS	37°	52°
LLP4 HM CD	45°	58°
LLP4 HW CS	55°	64°
LLP4 HW CSS	55°	64°
LLP4 HW CD	65°	69°

PARABOLIC BEAM SPREAD		
Trim	08LM - 33LM	40LM - 45LM
LLP4 NPR CS	51°	57°
LLP4 NPR CSS	56°	63°
LLP4 NPR CD	68°	71°
LLP4 P CS	65°	67°
LLP4 P CSS	65°	71°
LLP4 P CD	69°	73°
LLP4 WPR CS	75°	78°
LLP4 WPR CSS	77°	79°
LLP4 WPR CD	79°	80°

LUMEN MULTIPLIERS

CCT	MULTIPLIER
2700K	0.90
3000K	0.96
3500K	1.00
4000K	1.02
5000K	1.04

CRI	MULTIPLIER
80CRI	1.00
90CRI	0.83
97CRI	0.77

HYPERBOLIC TRIM	MULTIPLIER
LLP4 HN CS	0.94
LLP4 HN CSS	0.94
LLP4 HN CD	0.87
LLP4 HM CS	0.99
LLP4 HM CSS	0.97
LLP4 HM CD	0.91
LLP4 HW CS	1.00
LLP4 HW CSS	0.96
LLP4 HW CD	0.90

PARABOLIC TRIM	MULTIPLIER
LLP4 NPR CS	0.92
LLP4 NPR CSS	0.88
LLP4 NPR CD	0.86
LLP4 P CS	1.00
LLP4 P CSS	0.93
LLP4 P CD	0.94
LLP4 WPR CS	0.93
LLP4 WPR CSS	0.91
LLP4 WPR CD	0.88

Applying Lumen Multipliers to Calculate Delivered Lumens							
Base Fixture Delivered Lumens (from Performance Table)	x	CCT Multiplier	x	CRI Multiplier	x	Trim Multiplier	= Delivered Lumens for Desired Fixture and Reflector
Hyperbolic Reflector Example: LLP4 23LM 30K MVOLT 90CRI G4 ZT HM CD							
2559 Lumens	x	0.96	x	0.83	x	0.91	= 1886 Lumens
Parabolic Reflector Example: LLP4 23LM 30K MVOLT 90CRI G4 ZT NPR CSS							
1943 Lumens	x	0.96	x	0.83	x	0.88	= 1362 Lumens

LLP4-LLPRM4

PRODUCT SPECIFICATIONS

OPTICS

Hyperbolic: Unique hyperbolic shape optimized for small, directional LED source, maximizes fixture efficiency while creating the "Silent Ceiling" appearance by reducing lamp image and aperture brightness

- Geometry of hyperbolic curve provides unique aperture appearance and smoother light distribution

Parabolic/Lens: Computer-optimized parabolic reflector with frosted convex lens regressed into cone provides uniform distribution with no striations

Wall Wash: Available in Hyperbolic and Parabolic. Both providing uniform distributions with no striations

ELECTRICAL

LED Light Engine: Compact light source delivers uniform illumination without pixilation, enabling excellent beam control

- 2SDCM (5000K within 3SDCM)
- 80, 90 & 97 CRI
- Replaceable light engine with push in wire connections

Passive Cooling: Aluminum heat sink integrated directly with housing provides superior thermal management to ensure the long life of LED

LED Driver: Power factor >0.9

- Easily replaceable from above or below the ceiling

Dimming: Dimmable via 0-10V protocol standard

- Optional drivers available for use with eldoLED, Lutron EcoSystem, 2-wire dimmers, or DALI
- For a list of compatible dimmers, see [LED-DIM](#).

Life: Rated for 60,000 hours at 70% lumen maintenance

- Available with optional Lumen Depreciation Indicator, LDI option (U.S. Patent No. 9,119,269)

Emergency Battery Pack (Optional) output: Provides a minimum of 600 (BR), or 1000 (HBR) lumens for a minimum duration of 90 minutes

- BRT20C, HBR20C options are CEC Title 20 compliant
- All battery packs are remote mounted

MECHANICAL

New Construction Housing: Low profile, universal housing design installs in suspended grid, plaster or drywall

- Integral heat sink conducts heat away from LED light engine
- Driver is accessible from above and below ceiling and can be upgraded to accommodate future technology improvements

Mounting Frame: Heavy gauge steel lower housing ring accommodates ceilings up to 1-1/4" thick

Mounting Bracket: New Construction mounting brackets have vertical adjustment and accepts most commercial bar hangers, including our proprietary Tru-Lock bar hangers

- Our one-piece Tru-Lock bar hangers have integral T-bar locking screws and alignment notches for locating and locking fixture in the center or 1/4" tile increments

Junction Box: 3" x 8" galvanized steel junction box with (3) 1/2" knockouts facilitate quick wiring

- New Construction junction box rated for four (4) No. 12 AWG 90° C branch circuit conductors (2-in, 2-out)

Flangeless Adapter: Must specify IFMA4 when flangeless, "FM" option, is specified


Remodel Housing: Housing installs from below ceiling in applications where above ceiling access is not available

- Remodel springs accommodate ceilings from 5/8" to 1-1/8" thick
- Integral heat sink conducts heat away from LED light engine
- Driver is accessible from below the ceiling and can be upgraded to accommodate future technology improvements.

Remodel Junction Box: 2.75" x 4.5" galvanized steel junction box with (8) 1/2" knockouts facilitate quick wiring

LABELS AND LISTINGS

Tested to UL1598 and CSA C22.2 250 listed for feed through and damp location

- Chicago Plenum version is IC rated for 08LM – 23LM (no spray foam insulation)
- RoHS compliant
- EMI complies with FCC 47, Part 15, Class A
- I.B.E.W. Union made
- ARRA Compliant 



Warranty: 5 years when used in accordance with manufacturing guidelines.

Specifications subject to change without notice.


LLP4-LLPRM4

ORDERING INFORMATION - INDIVIDUAL COMPONENTS (Use when ordering rough-in and LED Trim Module separately)

Rough-In Only


Series	Light Engine	Voltage	Gen	Driver	Rough-In Options
LLP4 New Construction Rough-In  LLPRM4 Remodel Rough-In 	08LM 13LM 15LM 17LM 23LM 28LM 33LM 40LM 45LM	120 277 347 MVOLT (120-277)	G4	EDAB ^{2,4} eldoLED SOLOdrive DALI. Logarithmic dimming to <1% EZ10 ⁵ eldoLED 0-10V ECOdrive. Linear dimming to 10% min. EZ1 ³ eldoLED 0-10V ECOdrive. Linear dimming to 1% min. EZB ³ eldoLED 0-10V SOLOdrive. Logarithmic dimming to <1% FD ^{4,5} Forward or Reverse Phase Dimming Driver ECOD ¹⁷ Lutron Ecosystem Dimming Driver FDL ¹⁸ Forward Phase Dimming Lutron GZ1 0-10V Dimming to 1% min ZT 0-10V Dimming to 10% min	F ^{2,4} Fuse and Fuse Holder CP ^{7,12,14} Chicago Plenum LDI Lumen Depreciation Indicator BR ^{2,12} Emergency Battery Pack BRT20C ^{2,12} Emergency Battery Pack, Title 20 Compliant HBR ^{2,12} High Lumen Emergency Battery Pack HBRT20C ^{2,12} High Lumen Emergency Battery Pack, Title 20 Compliant NL ^{6,15} nLight® Dimming Pack Controls NLER ^{6,15} nLight® dimming pack controls. nLER controls fixtures on emergency circuit NLTAIR ^{2,13} nLight® AIR Dimming Pack Wireless Controls NLTAIRER ^{2,13} nLight® AIR Dimming Pack Wireless Controls. Controls fixtures on emergency circuit

LED Trim Module Only - Includes Reflector

Series	Light Engine	CCT	Gen	CRI	Options	Trim Style	Finish	Trim Option	Mounting
LLP4 Trim & Module (Includes Reflector) 	08LM 13LM 15LM 17LM 23LM 28LM 33LM 40LM 45LM	27K 30K 35K 40K 50K	G4	80CRI 90CRI 97CRI ¹	CP ^{7,12,14} Chicago Plenum	HM Hyperbolic Medium HN Hyperbolic Narrow HW Hyperbolic Wide HWS Hyperbolic Single Wall Wash P Parabolic Medium NPR ^{9,16} Parabolic Narrow WPR ^{9,16} Parabolic Wide WC Corner Wall Wash WD Double Wall Wash WS Single Wall Wash	BD Black Diffuse BS Black Specular BZD Bronze Diffuse BZS Bronze Specular CD Clear Diffuse CS Clear Specular CSS Clear Semi-Specular GD Gold Diffuse GS Gold Specular PTD Pewter Diffuse PTS Pewter Specular WH White, White Flange WTD Wheat Diffuse WTS Wheat Specular	PF ¹¹ White Flange WET ⁶ Wet Location	Blank Flanged FM ¹⁰ Flangeless

ORDERING INFORMATION - REPLACEMENT PARTS

Replacement Reflector Only

Series	Trim Style	Finish	Trim Option	Mounting
LLP4 Low Profile Reflector only 	HM Hyperbolic Medium HN Hyperbolic Narrow HW Hyperbolic Wide HWS Hyperbolic Single Wall Wash P Parabolic Medium NPR ^{9,16} Parabolic Narrow WPR ^{9,16} Parabolic Wide WC Corner Wall Wash WD Double Wall Wash WS Single Wall Wash	BD Black Diffuse BS Black Specular BZD Bronze Diffuse BZS Bronze Specular CD Clear Diffuse CS Clear Specular CSS Clear Semi-Specular GD Gold Diffuse GS Gold Specular PTD Pewter Diffuse PTS Pewter Specular WH White, White Flange WTD Wheat Diffuse WTS Wheat Specular	PF ¹¹ White Flange WET ⁶ Wet Location	Blank Flanged FM ¹⁰ Flangeless

Ordering Notes

- 2700K & 3000K only.
- Not available with 347V.
- Not compatible with LDI.
- Not available for NL, NLER, NLTAIR2, NLTAIRER2.
- 120V only. Not available with 40LM.
- Specify voltage.
- Not compatible with BR, BRT20C, HBR, HBRT20C.
- Compatible with Parabolic trim styles only.
- Not compatible with FM.
- IFMA4 required for FM.
- Not required when specifying WH finish.
- Not compatible with LLPRM4.
- Not recommended for metal ceilings.
- For 28LM - 45LM, specify voltage. Not available with ZT or GZ1 for 40LM and 45LM.
- LLPRM4 with NL or NLER options must be ordered with EZ1, EZB, or EZ10 drivers.
- NPR, WPR available with CS, CSS, CD, WH finishes only.
- Not compatible with LLPRM4 at 45LM. Not compatible with CP for 28LM and up.
- 120V only. Not compatible for 28LM and up. Not compatible with LLPRM4 for 23LM and up. Not compatible with CP.



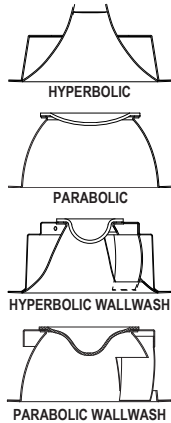
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4 of 12

LLP4-LLPRM4

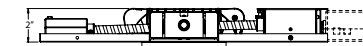
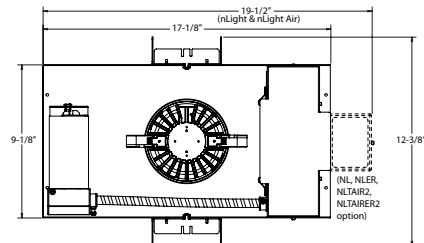
DIMENSIONAL DRAWINGS

TRIMS:

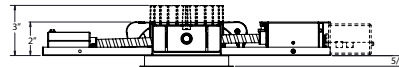


APERTURE: 4-1/4" Dia.
CEILING CUTOUT: 5" Dia.
OVERLAP TRIM: 5-1/2" Dia.

NEW CONSTRUCTION

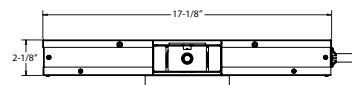
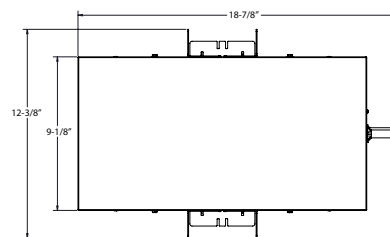


Up to 28LM

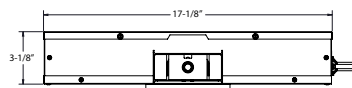


33LM or higher

NEW CONSTRUCTION – CHICAGO PLENUM

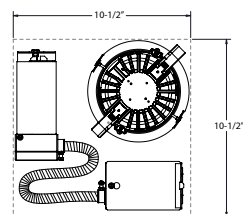


Up to 28LM



33LM or higher

REMODEL

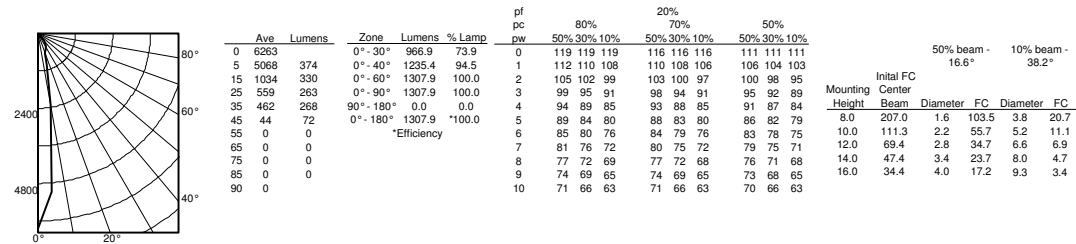


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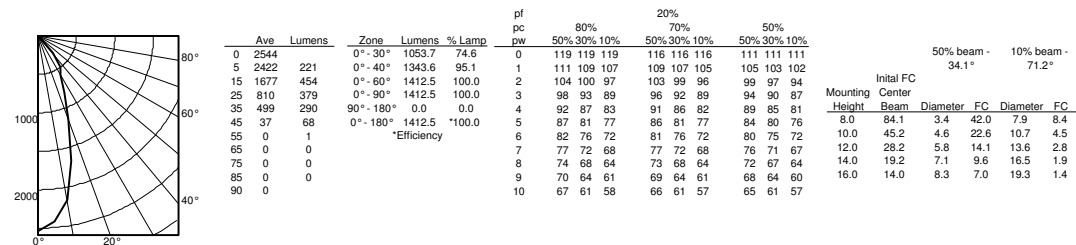
HYPERBOLIC PHOTOMETRICS

Distribution Curve Distribution Data Zonal Lumens Coefficient of Utilization Illuminance Data at 30" Above Floor for a Single Luminaire

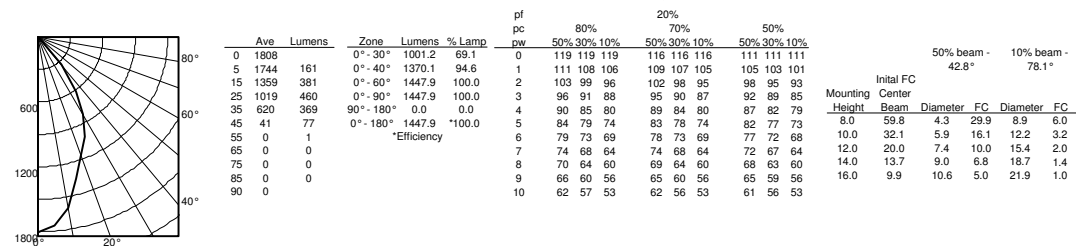
LLP4 13LM 35K + LLP4 HN CS, 3500K LEDs, input watts: 11.74, delivered lumens: 1307.9, LM/W = 111.4, Spacing Criteria: 0.3, test no. PR07172481, tested in accordance to IESNA LM-79.



LLP4 13LM 35K + LLP4 HM CS, 3500K LEDs, input watts: 11.74, delivered lumens: 1412.5, LM/W = 120.3, Spacing Criteria: 0.6, test no. PR07172482, tested in accordance to IESNA LM-79.



LLP4 13LM 35K + LLP4 HW CS, 3500K LEDs, input watts: 11.74, delivered lumens: 1447.9, LM/W = 123.3, Spacing Criteria: 0.8, test no. PR07172483, tested in accordance to IESNA LM-79.

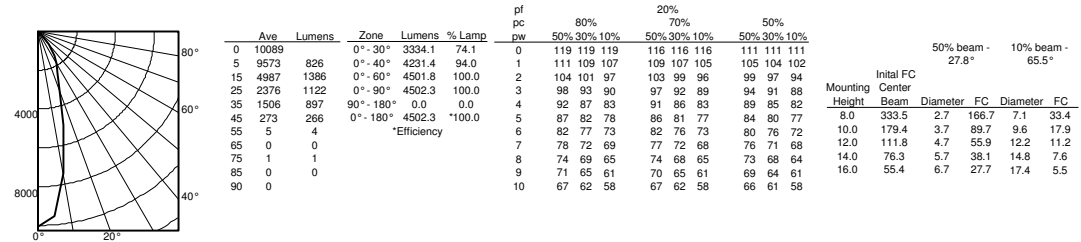


LLP4-LLPRM4

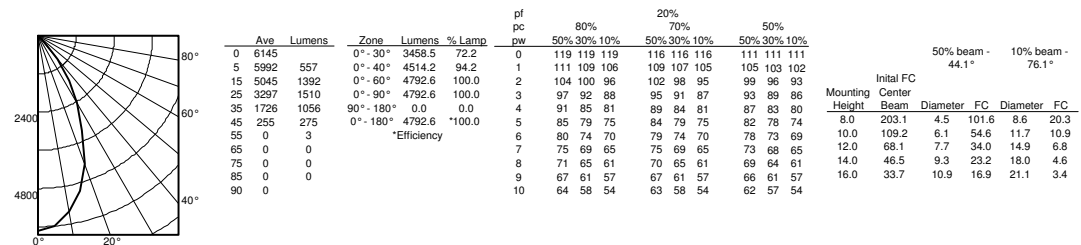
HYPERBOLIC PHOTOMETRICS

Distribution Curve Distribution Data Zonal Lumens Coefficient of Utilization Illuminance Data at 30" Above Floor for a Single Luminaire

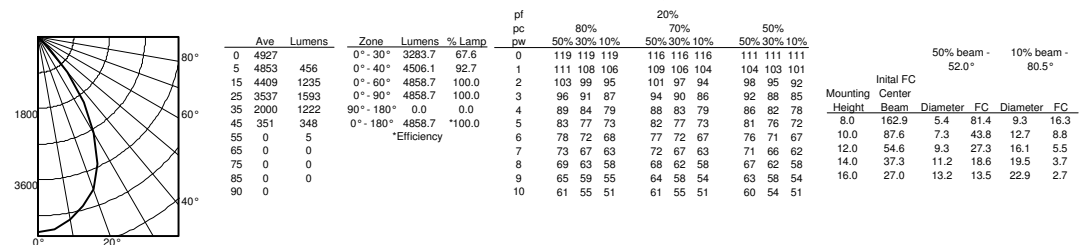
LLP4 45LM 35K + LLP4 HN CS, 3500K LEDs, input watts: 41.41, delivered lumens: 4502.3, LM/W = 108.7, Spacing Criteria: 0.5, test no. PR07172591, tested in accordance to IESNA LM-79.



LLP4 45LM 35K + LLP4 HM CS, 3500K LEDs, input watts: 41.41, delivered lumens: 4792.6, LM/W = 115.7, Spacing Criteria: 0.8, test no. PR07172582, tested in accordance to IESNA LM-79.



LLP4 45LM 35K + LLP4 HW CS, 3500K LEDs, input watts: 41.41, delivered lumens: 4858.7, LM/W = 117.3, Spacing Criteria: 1.0, test no. PR07172583, tested in accordance to IESNA LM-79.

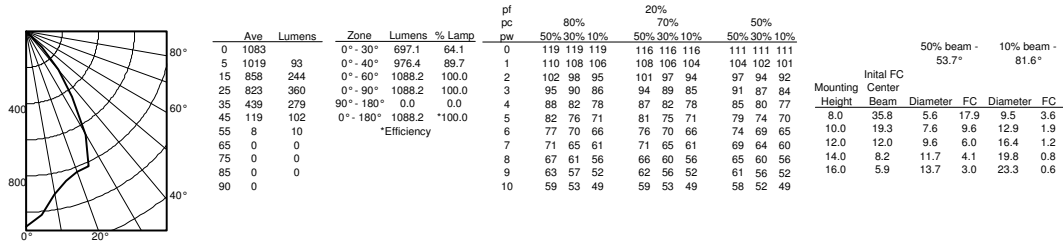


LLP4-LLPRM4

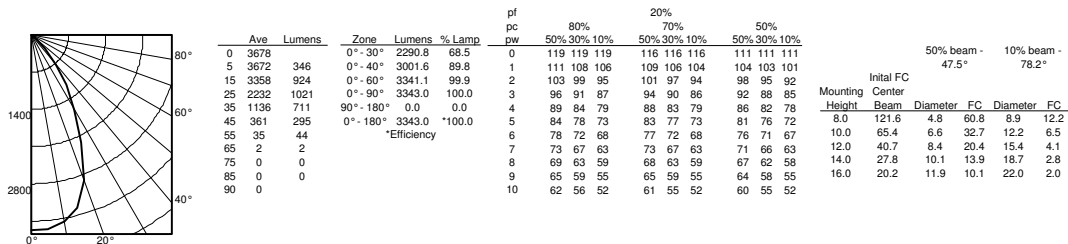
PARABOLIC PHOTOMETRICS

Distribution Curve **Distribution Data** **Zonal Lumens** **Coefficient of Utilization** **Illuminance Data at 30" Above Floor for a Single Luminaire**

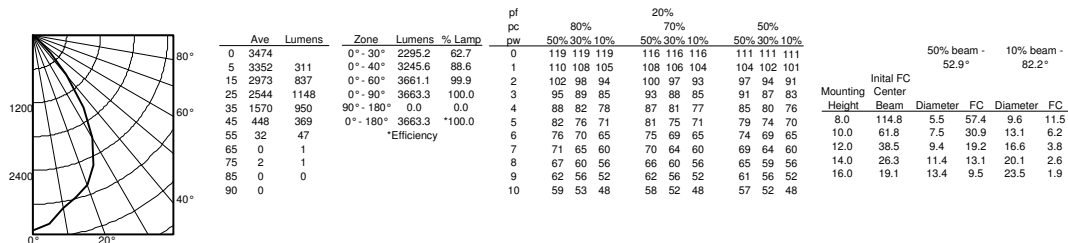
LLP4 13LM 35K + LLP4 P CS, 3500K LEDs, input watts: 11.74, delivered lumens: 1088.2, LM/W = 92.7, Spacing Criteria: 1.0, test no. PR07172484, tested in accordance to IESNA LM-79.



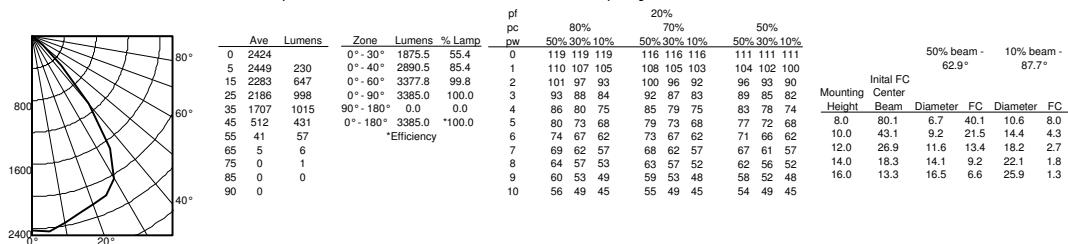
LLP4 45LM 35K + LLP4 NPR CS, 3500K LEDs, input watts: 41.41, delivered lumens: 3343, LM/W = 80.7, Spacing Criteria: 1.0, test no. PR11170691P, tested in accordance to IESNA LM-79.



LLP4 45LM 35K + LLP4 P CS, 3500K LEDs, input watts: 41.41, delivered lumens: 3663.3, LM/W = 88.5, Spacing Criteria: 1.0, test no. PR07172584, tested in accordance to IESNA LM-79.



LLP4 45LM 35K + LLP4 WPR CS, 3500K LEDs, input watts: 41.41, delivered lumens: 3385, LM/W = 81.7, Spacing Criteria: 1.0, test no. PR11170694P, tested in accordance to IESNA LM-79.



LLP4-LLPRM4

PERFORMANCE DATA

LUMINAIRES SPACED 2' FROM WALL

Catalog Number: LLP4 40LM 35K 120 G4 80CRI ZT; LLP4 HWS CD Spread: Single Wall Test #: PRO7172691

Single Unit						Lamp	Multiple Units On 2' Centers*			Multiple Units On 3' Centers*			Multiple Units On 4' Centers*		
Lateral Distance From Fixture 2' From Wall						BXRC-35E4000-D-73-SE	Spaced 2' From Wall			Spaced 2' From Wall			Spaced 2' From Wall		
0'	1'	2'	3'	4'	5'	Distance From Ceiling	CL	CL	CL	CL	CL	CL	CL	CL	CL
55	39	17	6	3	3	1'	90	87	90	66	56	66	59	34	59
69	54	27	11	5	4	2'	126	126	126	88	84	88	76	55	76
54	42	24	12	6	4	3'	106	104	106	75	71	75	63	49	63
39	34	23	12	7	5	4'	89	89	89	62	62	62	48	46	48
27	24	19	13	8	5	5'	71	71	71	50	50	50	38	39	38
19	17	15	12	8	6	6'	57	57	57	41	41	41	32	32	32
14	13	12	10	8	6	7'	47	47	47	34	35	34	27	27	27
11	11	10	8	7	6	8'	39	39	39	29	30	29	23	22	23
8	8	7	6	6	5	9'	30	31	30	23	24	23	18	18	18
6	6	5	5	5	4	10'	22	22	22	18	18	18	13	13	13

LUMINAIRES SPACED 3' FROM WALL

Catalog Number: LLP4 40LM 35K 120 G4 80CRI ZT; LLP4 HWS CD Spread: Single Wall Test #: PRO7172691

Single Unit						Lamp	Multiple Units On 3' Centers*			Multiple Units On 4' Centers*			Multiple Units On 5' Centers*		
Lateral Distance From Fixture 3' From Wall						BXRC-35E4000-D-73-SE	Spaced 3' From Wall			Spaced 3' From Wall			Spaced 3' From Wall		
0'	1'	2'	3'	4'	5'	Distance From Ceiling	CL	CL	CL	CL	CL	CL	CL	CL	CL
21	17	11	7	4	3	1'	32	32	32	26	24	26	23	17	23
37	32	21	13	7	5	2'	62	61	62	49	46	49	42	33	42
32	29	22	14	9	6	3'	60	60	60	46	46	46	39	35	39
28	25	19	13	9	6	4'	53	52	53	42	40	42	35	32	35
24	22	17	13	9	6	5'	48	49	48	38	38	38	31	30	31
20	18	16	12	9	7	6'	43	43	43	34	35	34	28	28	28
16	15	13	11	9	7	7'	39	39	39	30	30	30	25	25	25
12	12	11	10	8	7	8'	33	34	33	26	27	26	22	21	22
10	9	8	8	7	6	9'	27	28	27	22	22	22	18	17	18
7	7	7	6	5	5	10'	22	22	22	18	18	18	14	14	14

*Based on minimum of five luminaires. Reflectances: 80, 50, 20. Values are rounded to nearest whole footcandle.

Fixtures tested to IES recommended standard for solid state lighting per LM-79-08. Photometric performance on a single unit represents a baseline of performance for the fixture. Results may vary in the field.

LLP4-LLPRM4

PERFORMANCE DATA

LUMINAIRES SPACED 2' FROM WALL

Catalog Number: LLP4 40LM 35K 120 G4 80CRI ZT; LLP4 WS CSS Spread: Single Wall Test #: PR07172692

Single Unit						Lamp	Multiple Units On 2' Centers*			Multiple Units On 3' Centers*			Multiple Units On 4' Centers*		
Lateral Distance From Fixture 2' From Wall						BXRC-35E4000-D-73-SE	Spaced 2' From Wall			Spaced 2' From Wall			Spaced 2' From Wall		
0'	1'	2'	3'	4'	5'	Distance From Ceiling	CL	CL	CL	CL	CL	CL	CL	CL	CL
27	17	7	4	3	3	1'	42	38	42	34	23	34	32	14	32
60	37	14	7	5	4	2'	89	84	89	72	50	72	66	29	66
67	51	24	10	6	5	3'	119	119	119	85	79	85	76	49	76
41	38	27	14	7	5	4'	99	99	99	67	72	67	52	54	52
26	25	21	14	9	6	5'	77	78	77	55	55	55	41	44	41
19	18	16	13	10	7	6'	62	62	62	45	46	45	35	35	35
15	14	13	11	9	7	7'	51	51	51	38	39	38	30	30	30
12	11	10	9	8	7	8'	43	43	43	32	33	32	25	24	25
9	9	8	7	6	6	9'	33	34	33	26	27	26	20	20	20
6	6	6	5	5	4	10'	24	24	24	20	20	20	15	15	15

LUMINAIRES SPACED 3' FROM WALL

Catalog Number: LLP4 40LM 35K 120 G4 80CRI ZT; LLP4 WS CSS Spread: Single Wall Test #: PR07172692

Single Unit						Lamp	Multiple Units On 3' Centers*			Multiple Units On 4' Centers*			Multiple Units On 5' Centers*		
Lateral Distance From Fixture 3' From Wall						BXRC-35E4000-D-73-SE	Spaced 3' From Wall			Spaced 3' From Wall			Spaced 3' From Wall		
0'	1'	2'	3'	4'	5'	Distance From Ceiling	CL	CL	CL	CL	CL	CL	CL	CL	CL
12	9	6	4	3	3	1'	18	17	18	16	13	16	15	8	15
21	16	10	6	5	5	2'	32	30	32	28	22	28	25	14	25
32	25	15	9	6	5	3'	48	45	48	41	32	41	37	21	37
36	31	21	12	8	6	4'	58	58	58	47	44	47	41	31	41
27	26	21	14	9	7	5'	55	55	55	42	44	42	35	35	35
20	20	17	14	11	8	6'	49	49	49	37	39	37	30	32	30
16	16	14	13	11	9	7'	42	43	42	33	34	33	27	27	27
13	13	12	11	9	8	8'	37	38	37	29	30	29	24	23	24
10	10	9	9	8	7	9'	30	32	30	24	25	24	20	19	20
8	7	7	6	6	6	10'	24	24	24	19	19	19	16	16	16

*Based on minimum of five luminaires. Reflectances: 80, 50, 20. Values are rounded to nearest whole footcandle.

Fixtures tested to IES recommended standard for solid state lighting per LM-79-08. Photometric performance on a single unit represents a baseline of performance for the fixture. Results may vary in the field.

LLP4-LLPRM4

CONTROLS

EXAMPLE

Group Fixture Control*

*Application diagram applies for fixtures with eldoLED drivers only.

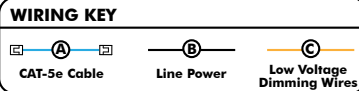
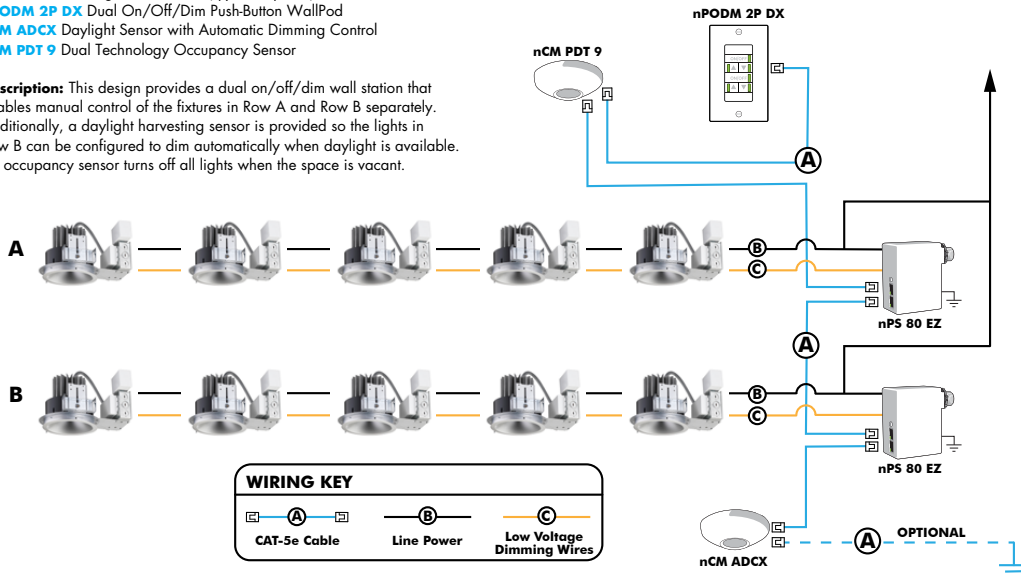
nPS 80 EZ Dimming/Control Pack (qty: 2 required)

nPODM 2P DX Dual On/Off/Dim Push-Button WallPod

nCM ADCX Daylight Sensor with Automatic Dimming Control

nCM PDT 9 Dual Technology Occupancy Sensor

Description: This design provides a dual on/off/dim wall station that enables manual control of the fixtures in Row A and Row B separately. Additionally, a daylight harvesting sensor is provided so the lights in Row B can be configured to dim automatically when daylight is available. An occupancy sensor turns off all lights when the space is vacant.



Choose Wall Controls

nLight offers multiple styles of wall controls - each with varying features and user experience.



Push-Button Wallpod
Traditional tactile buttons and LED user feedback



Graphic Wallpod
Full color touch screen provides a sophisticated look and feel

nLight® Controls Accessories:

Order as separate catalog number. Visit www.sensorswitch.com/nLight for complete listing of nLight controls.

WallPod Stations	Model number	Occupancy sensors	Model Number
On/Off	nPODM (Color)	Small motion 360°, ceiling (PIR/dual Tech)	nCM 9 / nCM PDT 9
On/Off & Raise/Lower	nPOD DX (Color)	Large motion 360°, ceiling (PIR/dual tech)	nCM 10 / nCM PDT 10
Graphic Touchscreen	nPOD GFX (Color)	Wide View (PIR/dual tech)	nWV 16 / nWV PDT 16
Photocell controls	Model Number	Wall Switch w/ Raise/Lower (PIR/dual tech)	nWSX LV DX / nWSX PDT LV DX
Dimming	nCM ADCX	Cat-5 cables (plenum rated)	Model Number
		10', CAT5 10FT	CAT5 10FT J1
		15, CAT5 15FT	CAT5 15FT J1



Capable Luminaire

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brand's specification for chromatic consistency.
- This luminaire is part of an A+ Certified solution for nLight control networks when ordered with drivers marked by a Shaded background*
- This Luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a shaded background*

To learn more about A+, visit www.acuitybrands.com/aplus.

*See ordering tree for details



LLP4-LLPRM4

nLight® AIR Control Accessories:

Order as separate catalog number. Visit www.acuitybrands.com/products/controls/nlightair.

Wall switches	Model number
On/Off single pole	rPODB [color]
On/Off two pole	rPODB 2P [color]
On/Off & raise/lower single pole	rPODB DX [color]
On/Off & raise/lower two pole	rPODB 2P DX [color]
On/Off & raise/lower single pole	rPODBZ DX WH¹

Notes

1 Can only be ordered with the RES7Z zone control sensor version.

nLight AIR

nLight AIR is the ideal solution for retrofit or new construction spaces where adding communication is cost prohibitive. The integrated nLight AIR rPP20 Power Pack is part of each Indy L-Series Luminaire. These individually addressable controls offer the ultimate in flexibility during initial setup and for space repurposing.



Simple as 1,2,3

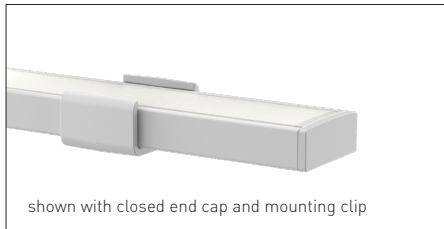
1. Install the nLight® AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CLAIRITY app, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome



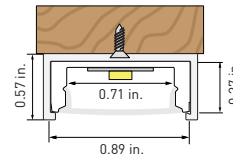
ALLOY LED®

Polymer Channel Specifications
an essential accessory for clean, efficient, and high-impact linear lighting installations

Polymer Low-Profile Surface-Mount Channel



APPROVED ALTERNATE MANUFACTURERS:
1. Prizm Lighting - TLS Series with extrusion
2. Luminii - Kendo M Series



The Polymer Low-Profile Surface-Mount Channel is wide and very low-profile, which makes it ideal for areas that call for a discreet light fixture. This polymer channel is semi-flexible for easy handling and can be used without a diffuser cover as a mounting track.

- Channel covers protect LED tape light
- Frosted diffuser covers provide smooth light diffusion
- Easy to handle flexible polymer
- Lightweight

All parts are sold separately.

Item #	Description
AL-82-01-0011-PART	polymer low-profile surface-mount channel, 4 ft.
AL-82-01-0015-PART	polymer low-profile surface-mount channel, 7 ft.
AL-82-01-9902-FRT	frosted diffuser cover, 4 ft.
AL-82-01-9905-FRT	frosted diffuser cover, 7 ft.
AL-82-01-9951-WH	plastic end caps 1 pair pack: 1 open, 1 closed
AL-82-01-9981-WH	plastic mounting clips & screws - 1 pair

This channel is compatible with selected tape light models only, see the "Channel and Tape Light Compatibility & Hotspot Guide" PDF on the Resources page on our website for information.

ALLOY LED®

Tape Light Specifications

PrimaLine® 2.7 LP (Low-Profile) LED Tape Light



PrimaLine 2.7 LP is a low-profile, medium output, dimmable LED light that is designed with specialized diodes to emit a smooth, even line of continuous light. PrimaLine 2.7 LP features the new 2110 diode, a low profile LED chip arranged in a tight array to ensure hotspot-free lighting in most Alloy LED channels.

- Smooth, hotspot-free line of light
- Ultra low profile
- New 2110 diodes
- 97 CRI (Color Rendering Index)
- Very high R9 and R13 values for superb rendering of warm tones



Stocked CCTs (Kelvin Temp.)*	2200K, 2400K, 2700K, 3000K, 4200K
Power Consumption per ft.	2.7 Watts / 113mA
Input Voltage	24V DC
Diodes per foot	84
Diode Spacing	0.14 inches
Tape Height	0.02 inches
Beam Angle	120°
Field Cuttable (UL 2108)	Every 1 inch
Max Run Length	13 ft.
Dimmable	Yes

* In addition to stocked colors, a wide variety of kelvin temperatures is also available by special order. Please call or email to order.

Diode Type	2110 SMD
Mounting	3M™ Self-Adhesive Tape (non-porous)
Operating Temp.	-13° F to 140° F
Ambient Temp.	-40° F to 186° F
Spool Length^	13 ft., 26 ft.
Location	Indoor, Dry
Certifications	UL Listed, UL 2108
Warranty	6 Year Limited

^Each spool comes with 36 in. 20 AWG tinned lead wires at one end and a 36 in. wire with female DC plug at the other.

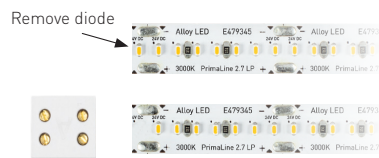
13 ft. spool	26 ft. spool	Kelvin Temp. (CCT)	Watts / foot	CRI	R9 Value	R13 Value	TM30	CQS	Lumens / foot
AL-01-08-2400	AL-01-08-2420	2200K	2.7W	97	91	97	n/a	n/a	160
AL-01-08-2401	AL-01-08-2421	2700K	2.7W	97	97	97	n/a	n/a	188
AL-01-08-2402	AL-01-08-2422	3000K	2.7W	97	95	96	n/a	n/a	202
AL-01-08-2403	AL-01-08-2423	4200K	2.7W	97	98	99	n/a	n/a	224
AL-01-08-2404	AL-01-08-2424	2400K	2.7W	97	98	99	n/a	n/a	170



Amp Champ Professional Connector - for a more secure connection.
Accepts many combinations of tape and wire. Includes spade connectors for stranded wire, 3M® adhesive backing, and pre-attached 6 inch in-wall-rated 18 AWG lead wire.

AL-01-08-9900
AL-01-08-9900-5 (5 pack)
AL-01-08-9900-10 (10 pack)

Note: The diode adjacent to the cut point must be removed prior to connecting the Amp Champ.

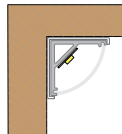


Accessories (sold separately)

→ Popular Channel Pairings



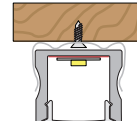
Surfa 3
Surface-Mount



Surfa 2
Corner-Mount



Naro 4
Recessed



Surfa 7
Surface-Mount



Click the square to see the Tape Light and Channel Compatibility & Hotspot Guide for a complete list of compatible channels and hotspot ratings.

Wire and Tape Light Management



Wire Harness
Holds wire in place securely.
L = 0.95 / W = 0.3 / H = 0.22 in.
(AL-01-99-9901)



Tape Harness
Provides extra security for tape light, especially at the ends of a run.
L = 0.87 / W = 0.2 / H = 0.125 in.
(AL-01-99-9900)

Compatible Power Supplies (sold separately)

Alloy LED Primavolt® Dimmable Power Supplies w/ETL Listed Junction Box

Smooth dimming using forward-phase ELV, MLV, and TRIAC dimmers.



dry location model



wet location model



Item #	Output	Wattage	Min. Load	Wet Loc.	Class 2
AL-98-03-24024-NM	24V DC	24W	none	N	Y
AL-98-03-24048-NM	24V DC	48W	none	N	Y
AL-98-03-24060-NM	24V DC	60W	none	N	Y
AL-98-03-24080-NM	24V DC	80W	none	Y	Y
AL-98-03-24096-NM	24V DC	96W	none	Y	Y
AL-98-03-24150-NM	24V DC	150W	none	Y	N
AL-98-03-24200-NM	24V DC	200W	none	Y	N

Note: Alloy LED strongly recommends using Listed Class 2 power supplies for all installations. Always install in accordance with local and national electrical code regulations.

Lutron® Dimming Accessories

By participating in Lutron's 2017 OEM Advantage program, Alloy LED is able to offer a range of the highest quality low voltage power supplies and selected controls on the market.



Hi-lume Premier
0.1% EcoSystem /
3-wire LED Driver
(96W 24VDC)



Hi-lume 1% LED
Driver 40W
- EcoSystem / 3-wire
control
- 2-wire 120V forward
phase control



Lutron Vive PowPak RF Module
- RF module for EcoSystem LED
driver control
- Use with the Lutron EcoSystem
drivers shown to "Vive-enable"
Alloy LED products

Lutron® Hi-lume LED Drivers

Item #	Output	Wattage	Min. Load	Class 2
AL-98-07-24040	24V DC	40W	n/a	Y
AL-98-07-24040-3WIRE	24V DC	40W	n/a	Y
AL-98-07-24096-3WIRE	24V DC	96W	n/a	Y

Lutron® Controls

Item #	Desc.	Voltage
AL-98-07-9901	EcoSystem Control Module	n/a
AL-98-07-9901-8	EcoSystem Control Module - 8 pack	n/a
AL-98-07-9950	CL Dimmer	120V AC
AL-98-07-9950-FPLATE	CL Dimmer faceplate	n/a

Dimmers & Switches

SlimDim Wireless Dimmers

Using long-range RF technology, these LED dimmers avoid the need for connecting directly to a power supply, offering freedom to mount anywhere. Can also be used as a fob for mobile, hand-held control.



AL-70-01-0001	SlimDim Wireless Dimmer
AL-70-01-0002	Single Color Receiver (96W max.) (sold separately)

Remote Control Dimmer Switch

Provides full dimming and on/off control, and includes a touch wheel that allows for direct visual selection of brightness. It can also operate up to four independent zones



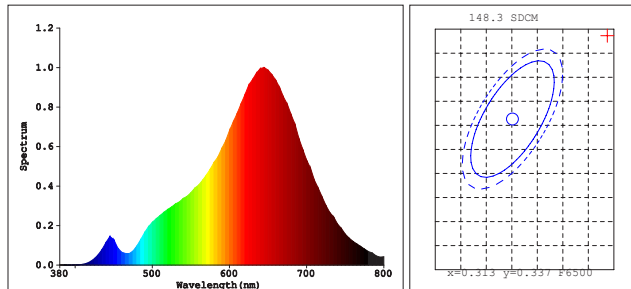
AL-60-03-0001	Remote Control Dimmer Switch
AL-70-01-0002	Single Channel Receiver (sold separately)
AL-60-03-0004	Wireless Receiver (sold separately)

ALLOYLED®

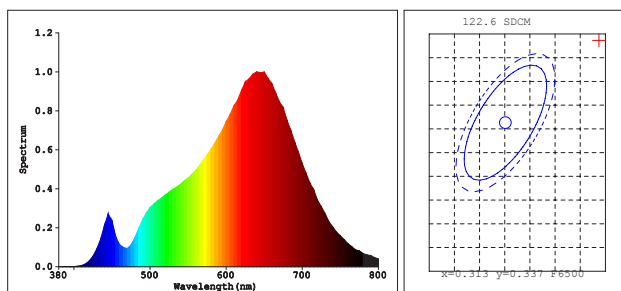
→ Alloy LED Light Lab™ Photometrics

Note: specifications are representative of the diode type and not a particular tape light article.

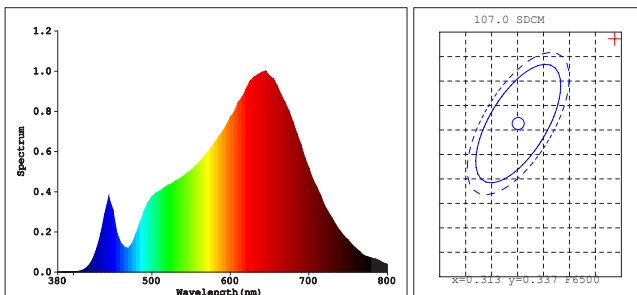
2200K



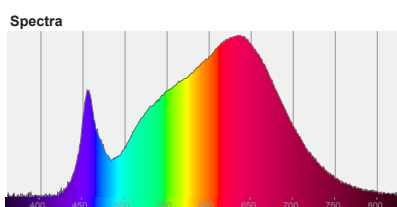
2400K



2700K



3000K

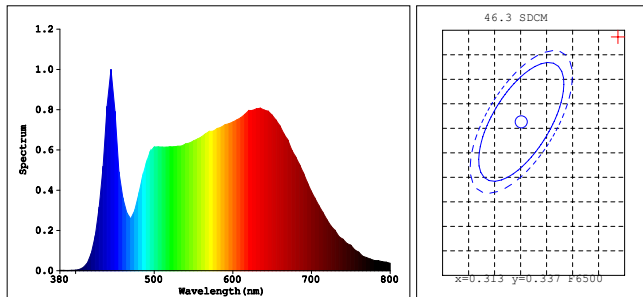


ALLOY LED®

4200K

→ Alloy LED Light Lab™ Photometrics

Note: specifications are representative of the diode type and not a particular tape light article.

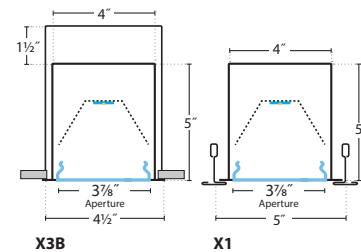


LED P43 | Recessed Linear
4" Slot



Type: **L10**

Job:



UP TO **99** LM/W

	LO	MO	SO	HO
SAL-D1:	Im/ft 450	675	900	1000
	w/ft 4.5	7	10	12
AWL-D1W:	Im/ft 450	675	900	1000
	w/ft 4.5	7	10	12

Open office illumination, wall washing or grazing, P43 has it all.

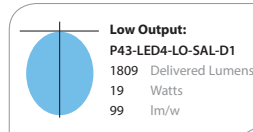
Industry best combination of optics, efficacy and aesthetics. See our Bionic Series for the same great optics with an aluminum housing.

P40 Series includes:

P40 - Direct Linear (Wash & Graze Optics)

P46 - Direct/Indirect Linear (Wash & Graze Optics)

P42 - 1" Regress Recessed Linear



COORDINATE VERTICAL LENGTH WITH ARCHITECTURAL DRAWINGS.



Lumen output may vary +/- 5%
4000K used for lm/ft estimates above
3500K -2% llf, 3000K -4%, 2700K -6%
-10% LLF for 90 CRI (4K, 3500K and 3K)
See LED Details PDF for more info

SE-RIES	LED COLOR	OUT-PUT	NOMINAL LENGTH	TRIM COLOR	SHIELDING	DISTRIBUTION	CIRCUITING	VOLT-AGE	CEILING SYSTEMS	DRIVERS	OPTIONS, SENSORS & CORNERS
P43											
	LED27 2700K (90CRI) LED3 3000K LED35 3500K LED4 4000K LED3-90 90CRI LED35-90 90CRI LED4-90 90CRI	LO Low MO Medium SO Standard HO High PROG Programmable Light Output (Specify desired lumens or watts per fixture)	2' 3' 4' 6' 8' R (Row length) NOTE: Individual not intended for row mounting	TMW Textured Matte White (Standard) YGW Gloss White Y Premium Color CC Custom Color	SAL* Satin Acrylic Lens OPL* Opal Frost Lens SPL-OL* Silver Parabolic Louver BLA-OL* Bladed Louver Anodized BLW-OL* Blade Louver White * D1 only † Louvers have a thin acrylic overlay masking LEDs AWL Acrylic Wall Wash Lens (D1W / D1R only) AWW Acrylic Wall Grazer Lens (D1G only)	D1 Direct (SAL, OPL, SPL-OL, BLA-OL or BLW-OL) D1W Wall Wash (AWL only) D1R Asymmetric to Room (AWL only) D1G Wall Grazer (AWW only)	SC Single Circuit UNV (120-277) 347 (Emergency battery requires a Step Down transformer)	X1 T-Bar 1/2" Exposed X1M T-Bar 1/2" Exposed X2 Dimensional T-Bar Armstrong Interlude® X6 Slot Grid X3B Hard Ceiling Flange Trim (Overhead mounting brackets) X7 Hard Ceiling (Trimless mud-over concealed flange)	ND Non-Dimming DM10 0-10v, 10% Dimming (Standard) DM01 0-10v, 1% Dimming STEP Step Dimming, 100-50-Off, Osram NOTE: Lumens and watts per foot may differ for STEP drivers, consult factory LDE* 5-Series EcoSystem LED LDE1* Hi-lume 1% EcoSystem LED (Soft fade on, fade-to-black dimming) LTE* Hi-lume 1% 2-Wire LED Driver (120V forward phase only) * Lutron NA HO ECO 1% 0-10v, EidoLED ECDA 1% DALI, EidoLED SOLO 0.1% 0-10v, EidoLED (Dim to Dark) SODA 0.1% DALI, EidoLED (Dim to Dark)	EML* Emergency Battery, Low (D1, D1W ~850 delivered lumens, D1G ~600) EMH* Emergency Battery, High (D1, D1W ~1175 delivered lumens, D1G ~900) SENSORS: 205 WattStop PIR Occupancy 205-STEP: Dim to 50% 205-DM: Dim to 10% / 1% LUX Phillips DLH ENL Enlighted 2-Wire DLH & Environmental CORNERS: C2I Lit 90° 2-Way Inside C2O Lit 90° 2-Way Outside C2X Special Angled (Consult factory) C8I Wall to Ceiling Inside C8O Wall to Ceiling Outside	

LED P43 | Recessed Linear 4" Slot



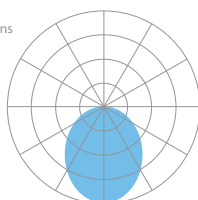
PRUDENTIAL LTG.

PRULITE.COM 213.746.0360

SAL-D1 GLOW

Low Output:

P43-LED4-LO-SAL-D1
1809 Delivered Lumens
19 Watts
99 lm/w
4000 CCT
Test #102953252LAX-004



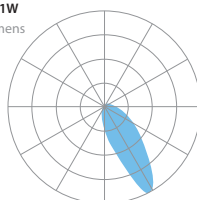
Zonal Lumen Summary:
0-90 = 100%

Vertical Angle	0°	25°	45°	65°	90°
0°	769	769	769	769	769
5°	762	763	763	760	760
15°	720	717	709	698	693
25°	642	632	612	592	582
35°	538	522	494	469	457
45°	421	403	373	349	337
55°	303	303	263	243	234
65°	199	188	171	157	151
75°	100	93	84	78	75
85°	24	23	21	21	20
90°	0	0	0	0	0

WALL WASH (AND D1R)

Standard Output:

P43-LED3-SO-AWL-D1W
3681 Delivered Lumens
39 Watts
94 lm/w
3000 CCT
Test #32273



Zonal Lumen Summary:
0-90 = 100%

Vertical Angle	0°	22.5°	45°	67.5°	90°
0°	785	785	785	785	785
5°	979	969	920	850	786
15°	1638	1548	1307	1000	763
25°	2136	2065	1742	1147	715
35°	1909	1946	1894	1253	644
45°	1358	1400	1541	1238	548
55°	863	890	991	1000	425
65°	463	491	552	597	276
75°	186	199	236	258	134
85°	39	40	45	50	26
90°	0	0	0	0	0

Luminance Chart:

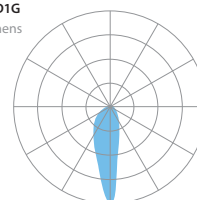
Angle	0°	45°	90°
45°	19987	22681	8059
55°	15662	17972	7704
65°	11399	13595	6806
75°	7475	9493	5372
85°	4645	5326	3117

NOTE: D1R - Use D1W IES Files and flip in room application software.

WALL GRAZER

High Output:

P43-LED4-HO-AWW-D1G
2899 Delivered Lumens
47.4 Watts
61 lm/w
4000 CCT
Test #31700



Zonal Lumen Summary:
0-90 = 100%

Vertical Angle	0°	22.5°	45°	67.5°	90°
0°	2619	2619	2619	2619	2619
5°	2290	2337	2462	2578	2603
15°	1486	1526	1675	2096	2463
25°	1101	1134	1233	1588	2149
35°	787	814	898	1145	1692
45°	559	580	623	792	1141
55°	381	394	432	521	673
65°	255	260	272	311	346
75°	157	153	151	147	146
85°	54	50	47	41	32
90°	0	0	0	0	0

LUMEN MAINTENANCE

Designed to last with cool running mid-power LEDs projected to maintain 90% (L90) of their initial output for 100,000 hours (at HO), and L70 exceeding 150,000 hours.

LED SYSTEM

PROG (OPTIONAL)

LED modules and drivers are field replaceable. Programmable light output. Specify desired lumens or watts per linear foot. Min: 2½ w/ft, consult factory for requests above 12 w/ft.

BINNING

Standard binning (all Prudential LED boards) includes testing at the chip level and board integration to provide consistent color temperature within a 3-step MacAdams ellipse, with +/- 5% lumen output range and +/- .004 Duv.

PRUBIN™ (OPTIONAL)

Prudential Ltg's exclusive 'job binning' method that ensures color temperature consistency across all luminaires on a project. Meticulously testing and labeling EVERY LED BOARD to +/- 25 lumens, +/- 50k CCT and +/- .004 Duv — while also separating positive from negative — allows us to match color, hue and intensity throughout a project and provides a consistent color temperature within a 2-step MacAdams ellipse.

LABELS

ELECTRICAL

ETL damp labeled and I.B.E.W. manufactured.

Must specify LED dimming controls. LED fixtures have constant current driver(s) with less than 20% THD when loaded to a minimum of 60%. Drivers sink a maximum of 6mA per driver. DM10 LED drivers are 0-10V dimmable and are compatible with most 0-10V wall slide dimmers and direct 0-10V analog signal dimmers. Max driver size 1½" w x 1¼" h.

CONSTRUCTION

Housing	20-gauge steel, >20% PC recycled, 100% recyclable
Lens	Acrylic, 100% recyclable
Louvers	Aluminum, >25% PC recycled, 100% recyclable
X1, X2, X6 Trim	Steel
X3, X7 Trim	Extruded aluminum

MOUNTING

Recessed into drywall or T-bar ceilings

WARRANTY

Single-source, 5 year limited warranty covers standard components and construction.



Prudential Ltg. reserves the right to change design specifications or materials without notice. Please visit prulite.com for most current data.
© 2014 All rights reserved - All products manufactured at: Prudential Ltg. 1774 E. 21st Street, Los Angeles, CA 90058

Recessed Linear

2

02-27-2019

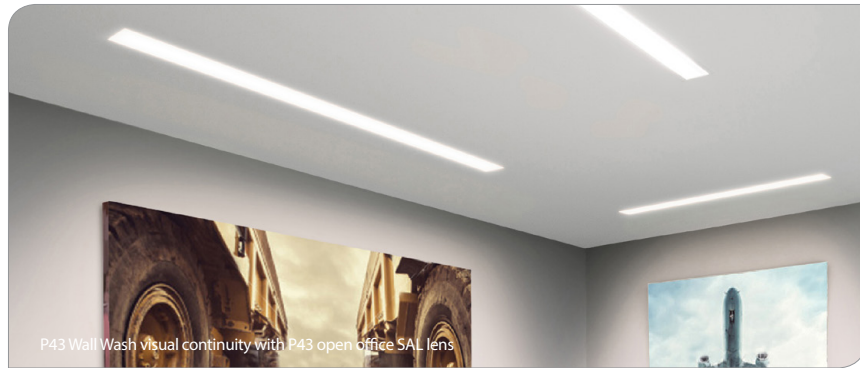
LED P43 | Recessed Linear
4" Slot



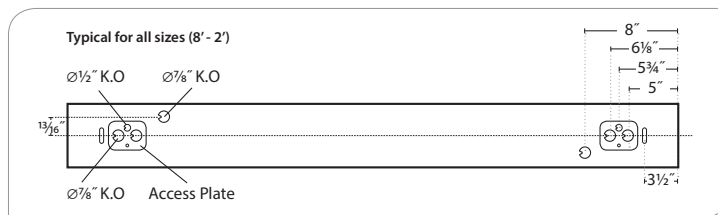
YSW – Seashell White (Matte)	YCH – Champagne (Metallic)
YSL – Silver (Metallic)	YPE – Pewter (Matte)
YRG – Rain Grey (Gloss)	YSTM – Storm Grey (Matte)
YBK – Black (Matte)	YBB – Black (Semi Gloss)
YSKM – Sky (Matte)	YMB – Military Blue (Matte)
YIB – Interstate Blue (Matte)	YSAM – Sapphire (Matte)
YFGM – Forest Green (Matte)	YBR – Bronze (Matte)
YBY – Boysenberry (Matte)	YSRM – Sunset Red (Matte)
YOR – Orange (Matte)	YDAM – Daffodil (Matte)

Choose from one of our Premium Colors with no set-up fee.

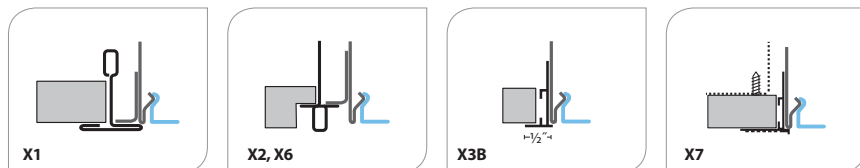
For paint chip samples, please email:
info@prulite.com



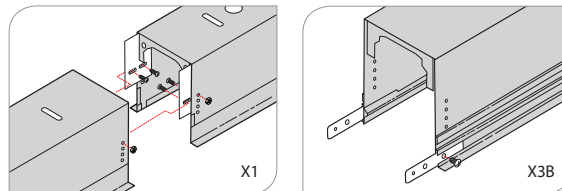
MOUNTING LOCATIONS



CEILING SYSTEMS

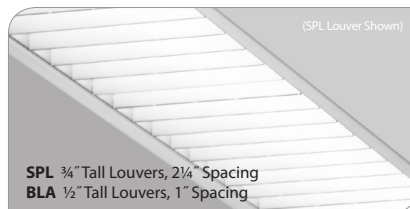


ADJOINING DETAILS



FRAMING DIMENSIONS X3B & X7
Add 1/2" in fixture width, Add 3/8" in fixture length or overall row length.

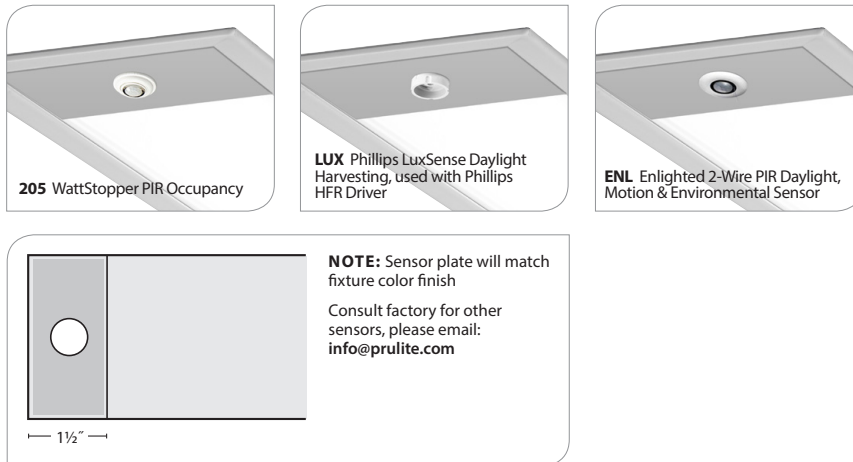
LOUVERS



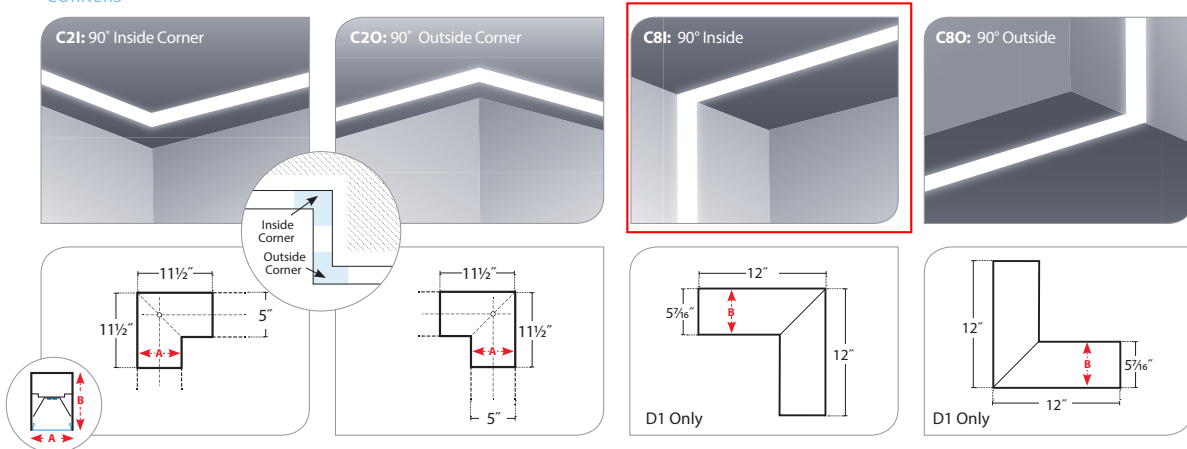
LED P43 | Recessed Linear
4" Slot



CONTROL SENSORS



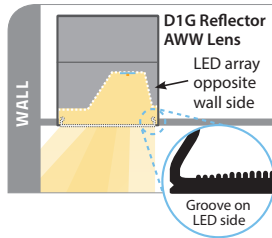
CORNERS



LED P43 | Recessed Linear
4" Slot



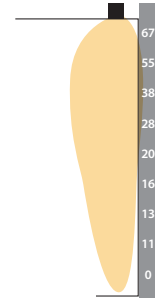
WALL GRAZER ORIENTATION



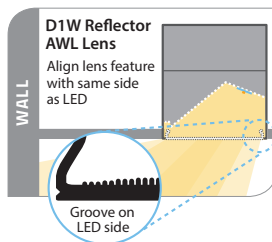
Smooth Wall Grazing.

A tight, focused beam grazes wall textures evenly, accenting and highlighting details to elevate the visual drama.

	Watts/Ft	Ceiling Height	Average Illuminance	Max	Min	Max/Min Ratio
Standard Output - 750 lm/ft	10	9'	40fc	76fc	16fc	4.75

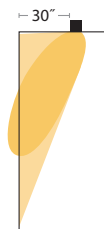


WALL WASH ORIENTATION



Wall Washing.

Our PruOptics™ reflector/refractor design delivers a high performance wall wash. No mechanical kickers needed.



	Watts/Ft	Ceiling Height	Average Illuminance	Max/Min	Max/Min Ratio
Standard Output - 750 lm/ft	10	9'	40fc	76/16	4.75

Footcandles on Wall

9'	26	28	29	28	26
8'	55	60	62	60	55
7'	67	73	76	73	67
6'	62	68	72	68	62
5'	51	56	59	56	51
4'	39	43	44	43	39
3'	29	31	32	32	29
2'	22	23	24	23	22
1'	16	17	17	17	16



X

RL

**Reliance Series
Thermoplastic LED Exit Sign**

Features

- Damp location listed.
- Super bright, long-life LEDs.
- Quick-connect components.
- Snap-on canopy for easy installation.
- Universal face plates for both single and double face standard.
- Nickel Cadmium battery provides 3 hours of emergency operation.
- Sealed External Momentary test switch and dual diagnostic LED indicator displays AC presence and Hi-Charge status.
- Self-Test / Self-Diagnostic monitoring available.
- Low voltage cut-off prevents battery damage and ensures positive charge acceptance following an extended discharge.
- Line-latch prevents unnecessary discharge of battery during installation. Loads will not illuminate until after application of utility power.
- 120/277 VAC field-selectable inputs (with the exception of the 2C (dual circuit) option which requires voltage specification upon ordering)³

Construction

- UV stabilized, UL94V-O flame retardant ABS injection-molded thermoplastic.

Letters

- 6" high; 0.75" stroke.

Arrows

- NFPA-Type, field selectable chevrons.





RL

Reliance Series Thermoplastic LED Exit Sign

Ordering Information

Series

RL

Operation

AC = AC Only

EM = NiCad Battery

Letters

R = Red

G = Green

Housing Color

WH = White

BK = Black

Mounting

UN = Universal Mounting Canopy

PA = 12" Swivel Pendant

PB = 24" Swivel Pendant

PC = 36" Swivel Pendant

PD = 48" Swivel Pendant

Options

SD = Self Diagnostics¹

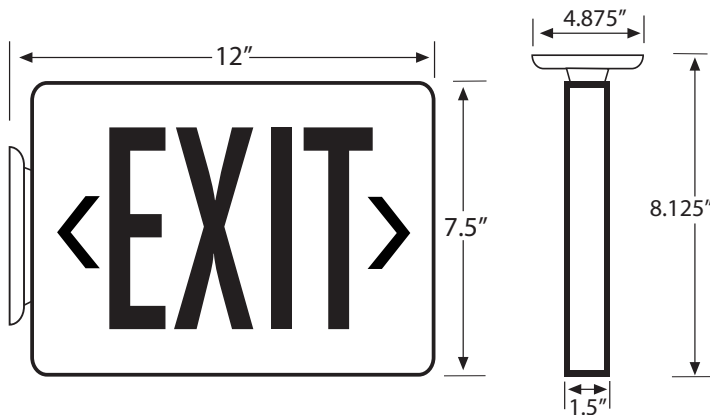
2C = Dual Circuit²³

Notes

1 = EM Only

2 = AC Only

3 = Specify Voltage



Temperature Rating

- From 32°F to 122°F

Approvals

- UL 924
- CEC Title 20 Compliant
- UL Listed for Damp Location
- NFPA Life Safety Code 101
- NFPA 70- NEC
- OSHA

Warranty

- Isolite offers a 3-year limited warranty. For further details, refer to General Warranty and Obligations in the Isolite manual or on our website.

www.isolite.com

Headquarters: 31 Waterloo Avenue • Berwyn, PA 19312 • 800-888-5483 • 610-647-8200

Western Office: 3563 Sueldo, Suite M • San Luis Obispo, CA 93401 • 800-799-5343 • 805-546-9669

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SECTION 27 05 00
TELECOMMUNICATIONS GENERAL REQUIREMENTS

PART 1 GENERAL.....	1
1.01 RELATED DOCUMENTS.....	1
1.02 SUMMARY	1
1.03 COORDINATION WITH OTHER TRADES.....	2
1.04 DRAWINGS.....	2
1.05 INSPECTION OF SITE.....	2
1.06 CONTRACT BREAKDOWN.....	2
1.07 TEMPORARY FACILITIES.....	2
1.08 ALTERNATES	2
1.09 GUARANTEE	2
1.10 CODES, PERMITS AND FEES	2
1.11 STANDARDS OF MATERIAL AND WORKMANSHIP:	3
1.12 RECORD DRAWINGS	3
1.13 MATERIAL AND EQUIPMENT MANUFACTURERS	3
1.14 SHOP DRAWINGS/SUBMITTALS.....	4
1.15 USE OF EQUIPMENT	4
1.16 WORK SPECIFIED UNDER OTHER DIVISIONS.....	4
1.17 WORK PROVIDED BY OTHERS.....	4
1.18 CONTRACTOR QUALIFICATIONS	4
PART 2 PRODUCTS	5
PART 3 EXECUTION.....	5
3.01 INSTALLATION OF EQUIPMENT.....	5
3.02 WORK PERFORMED BY OTHERS	5
3.03 DEMOLITION WORK.....	5
3.04 WORK IN EXISTING BUILDINGS	6
3.05 COORDINATION.....	6
3.06 CHASES AND RECESSES.....	6
3.07 SLEEVES	6
3.08 CUTTING, PATCHING AND DAMAGE TO OTHER WORK	6
3.09 ACCESS DOORS.....	6
3.10 CLEANING	7
3.11 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS	7
3.12 EXTRA WORK	7
3.13 DRAWINGS AND MEASUREMENTS.....	7
3.14 AUTOMATION SYSTEM PROGRAM CODE.....	7

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.
- B. Refer to the Wayne State University Standards for Communications Infrastructure found at: <https://tech.wayne.edu/docs/wsu-communications-standards.pdf>. The Wayne State University Standards for Communications Infrastructure shall supplement these specifications. In the event of inconsistencies or disagreement within the Division 27 specifications and the Wayne State University Standards for Communications Infrastructure, the Wayne State University Standards for Communications Infrastructure shall override the Division 27 specifications.

1.02 SUMMARY

- A. This Section includes telecommunications general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 1 Specification Sections.

1.03 COORDINATION WITH OTHER TRADES

- A. The Contractor shall coordinate the installation of the telecommunications wiring devices, equipment, supports, pathways etc., with all other trades prior to installation. Verify and coordinate routing of cable trays, conduits, wireways, etc., intended to support routings of telecommunications cabling.

1.04 DRAWINGS

- A. The Drawings must show the location of equipment racks & elevations, Ladder rack on 3 walls, power outlet locations, general arrangement of equipment, electrical systems and related items. The installation will follow as closely as elements of the construction will permit.
- B. The Drawings must show a conduit & cabling riser diagram from MDF and related IDF's. Copper pair and fiber strand counts will be detailed showing the distribution of riser cabling between the MDF and related IDF's.
- C. Deviations from the Drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer and WSU C&IT.
- D. The architectural and structural Drawings take precedence in all matters pertaining to the building structure, mechanical Drawings in all matters pertaining to mechanical trades and electrical Drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect and WSU C&IT for resolution.

1.05 INSPECTION OF SITE

- A. Visit the site, examine and verify the conditions under which the work must be conducted before submitting proposal.
- B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

1.06 CONTRACT BREAKDOWN

- A. WSU Facilities Department retains the installation and coordination for all projects initiated by that department. WSU C&IT retains the design review, installation and coordination for all other voice, data & video projects not initiated by WSU Facilities.
- B. Within two (2) weeks following award of contract, submit to the Architect/Engineer for approval a contract amount breakdown. Breakdown shall be submitted on a form similar to the form available at the Architect's/Engineer's office. All requests for payment shall be based on the approved breakdown.

1.07 TEMPORARY FACILITIES

- A. Provide and remove upon completion of the project, in accordance with the general conditions, a complete temporary telephone service during construction, as required.

1.08 ALTERNATES

- A. See Alternate Section and other applicable parts of the specifications.

1.09 GUARANTEE

- A. Contractor guarantees that the installation is free from defects and agrees to replace or repair, any part of this installation which becomes defective within a period of one year following final acceptance, provided that such failure is due to defects in the equipment, material or installation or to follow the specifications and drawings. File with the Owner any and all guarantees from the equipment manufacturers.

1.10 CODES, PERMITS AND FEES

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for telecommunications work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations.

- B. Rules of local service providers shall be complied with. Check with the local exchange carrier supplying service to the installation and determine all raceways and devices required including, but not limited to, all terminal cabinets, backboards, space requirements, etc.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.11 STANDARDS OF MATERIAL AND WORKMANSHIP:

- A. All materials shall be new. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
 - A.N.S.I. American National Standards Institute
 - A.S.T.M. American Society for Testing Materials
 - BICSI Building Industry Consulting Services International
 - I.C.E.A. Insulated Cable Engineer's Association
 - I.E.E.E. Institute of Electrical and Electronics Engineers
 - N.E.C. National Electrical Code
 - N.E.M.A. National Electrical Manufacturer's Association
 - NFPA National Fire Protection Agency
 - TIA Telecommunications Industry Association
 - U.L. Underwriters Laboratories, Inc.
- B. Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.
- C. All equipment of the same or similar systems shall be by the same manufacturer.

1.12 RECORD DRAWINGS

- A. Provide complete operating and maintenance instruction manuals covering all telecommunications equipment herein specified, together with parts lists. All literature shall be furnished in triplicate for Owner and shall be bound in book or ring binder form as directed by Architect/Engineer.
- B. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:
 - 1. Routine maintenance procedures.
 - 2. Trouble-shooting procedures.
 - 3. Contractor's telephone numbers for warranty repair service.
 - 4. Shop drawings.
 - 5. Recommended spare parts lists.
 - 6. Names and telephone numbers of major material suppliers.
- C. Provide revised telecommunications working Drawings indicating "as-built" conditions. Drawings shall indicate all changes that have occurred during construction. Properly and identify backbone and horizontal wiring pathways. Locate all network and workstation devices. Identify all devices on plan with proper labeling. Identify outside plant backbone conduits, man holes & fiber cables installed on a site plan. "as-Built" Drawings shall be submitted on AutoCAD 2000 or newer electronic DWG file format. Provide (1) copy paper and (1) copy electronic DWG file.
- D. Provide certified test records for all installed cable showing compliance with specifications. Provide (1) electronic copy of test results in PDF file.

1.13 MATERIAL AND EQUIPMENT MANUFACTURERS

- A. All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of telecommunications equipment and shall be of the manufacturer's latest design.

- B. No substitutions will be allowed without WSU C&IT approval.

1.14 SHOP DRAWINGS/SUBMITTALS

- A. All shop drawings shall be submitted in groupings of similar and/or related items (cable and connectors, equipment cabinets and racks, etc.). Incomplete submittal groupings will be returned unchecked.
- B. Provide detailed layout shop drawings of backbone and horizontal cabling distribution, pathways, equipment room layouts, details and related information necessary of installation and maintenance. After review by the Engineer, a copy of drawings will be stamped and returned to the contractor.
- C. Submit for approval two (2) copies of shop drawings for all telecommunications systems or equipment but not limited to the items listed below. Where items are referred to by symbolic designation on the Drawings and Specifications, all submittals shall bear the same designation. Refer to other sections of the Specifications for additional requirements.
1. Structured cabling system components.
 2. Structured cable system raceways and supports.
 3. Labeling equipment.
 4. Conduit, junction and pullboxes.
 5. Surface raceway components.
 6. Manholes, hand holes and all accessories.
 7. Telephone system components.
 8. Data network system components.

1.15 USE OF EQUIPMENT

- A. The use of any equipment or any part thereof for purposes other than testing even with the Owner's consent shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.

1.16 WORK SPECIFIED UNDER OTHER DIVISIONS

- A. The following items are an integral part of the telecommunications system and will be provided by the Electrical Contractor & or Telecommunications Contractor.
1. Raceways
 2. Boxes, cabinets and enclosures.
 3. Grounding and Bonding

1.17 WORK PROVIDED BY OTHERS

- A. Conduit, cabletrays, sleeves, boxes, floor boxes, surface raceways and grounding shall be provided by the Electrical Contractor under Division 26.
- B. Coordinate installation of telecommunications work with work provided by Electrical Contractor in paragraph A above.
- C. The Owner will provide network electronics equipment in all Communication Rooms as required.

1.18 CONTRACTOR QUALIFICATIONS

- A. The Installing Contractor for each communications system shall have a minimum of 5 years of experience with the types of systems specified. They must be certified to install, test & warranty the product specified prior to a bid submittal. **No exception to this will be allowed.**
- B. The Installing Contractor shall submit a reference list consisting of a minimum of 3 installations of equivalent size and complexity of this contract. The reference list shall contain the following information for each installation:
1. Name of project, square footage, location and brief description of systems.
 2. Date of completed installation.
 3. Contact name and phone number of facility representative.
 4. Total bid amount of each system installed.
 5. Final contract amount of each system installed, including all change orders and bulletins.
- C. The Installing Contractor shall submit with the bid the names and registration numbers of members of the firm that have a valid membership and are certified with BICSI as registered Communications

Distribution Designers (RCDD). This contractor shall identify at least one RCDD assigned to this project in the bid.

- D. The bidding, shop drawing submittal, procurement of materials, the installation as-builts and record documents shall be reviewed and overseen by the RCDD(s) assigned to the project.
- E. The contractor's bid, shop drawing submittals, as-builts and record documents shall bear the valid seal of the RCDD(s) assigned to this project.
- F. The Installing Contractor of the video system shall submit with the bid names and license numbers of all members of the firm that hold a valid commercial general class license with the FCC. The Contractor shall identify at least one FCC licensed technician/engineer assigned to this project with the bid.
- G. All calculations, shop drawings, testing, certification and as-built documents shall be directly supervised by the licensed technician/engineer assigned to the project.
- H. The contractor must provide a copy of the manufacturer's certification that the contractor is currently certified to install, test & warranty the proposed system prior to a bid submittal. See Section 17110, 7.5A and section 17010, 1.16A. No exception to this will be allowed.

PART 2 PRODUCTS

Not applicable.

PART 3 EXECUTION

3.01 INSTALLATION OF EQUIPMENT

- A. Install all equipment in strict accordance with all installation specifications set by the equipment manufacturer. Where such directions are in conflict with the Drawings and Specifications, report such conflicts to the Architect/Engineer and WSU C&IT for resolution.

3.02 WORK PERFORMED BY OTHERS

- A. Electrical Contractor shall install 4" sq. sheet steel wall boxes, minimum 1" trade size conduit (or as indicated on drawings) stubbed 12" above ceiling with 6" radius (or as required by TIA/EIA-569), with a 90 degree bend at top in the direction towards route destination, and plastic bushing for recessed locations.
- B. Electrical Contractor shall install 4" sq. cast boxes. Minimum 1" trade size conduit (or as indicated on Drawings) stubbed up to 10' AFF (or as indicated on Drawings), with 6" radius (or as required by TIA/EIA-569) for surface mounted locations.
- C. The Owner will provide access point & network electronics equipment in all Communications Rooms as required.
- D. The Owner will provide all voice & data cross-connect jumpers.

3.03 DEMOLITION WORK

- A. All demolition of existing telecommunications Cable, equipment and materials shall be specified by C&IT and done by this Contractor unless otherwise indicated. Include all items such as, but not limited to, cable, patch panels, devices, and wiring called out on the Drawings and as necessary whether such items are actually indicated on the Drawings or not in order to meet NFPA requirements.
- B. In general, demolition of old low voltage communications cabling work is indicated on the drawings, however, the contractor shall visit the job site to determine the full extent and character of this work. All existing voice & data jacks demolished need to be documented. A room number, Jack number (if still there), approximate location in the room & the communication room where it terminated need to be identified. This information must be returned to C&IT IT Customer Services Telecommunications department.
- C. None of the recovered material shall be reused in the new work.
- D. Where equipment or fixtures are removed, outlets shall be properly blanked off, and conduits capped. After alterations are done, the entire installation shall present a "finished" look, as approved

by the Architect/Engineer. The original function of the present systems to be modified shall not be changed unless required by the specific revisions to the system as specified or as indicated.

- E. Reroute cable as required to maintain service. Where walls and ceilings are to be removed as shown on the Drawings, the conduit is to be cut off by the Electrical Trades so that the abandoned conduit in these walls and ceilings may be removed with the walls and ceilings by the Architectural Trades. All dead-end conduit runs shall be plugged at the remaining outlet boxes or at the panels.
- F. Reroute signal wires, lighting and power wiring as required to maintain service. Where walls and ceilings are to be removed as shown on the drawings, the conduit is to be cut off by the Electrical Trades so that the abandoned conduit in these walls and ceilings may be removed with the walls and ceilings by the Architectural Trades. All dead-end conduit runs shall be plugged at the remaining outlet boxes or at the panels.
- G. Where new walls and/or floors are installed which interfere with existing telecommunications outlets, devices, etc., this contractor shall adjust, extend and reconnect such items as required to maintain continuity of same.
- H. All electrical work in altered and unaltered areas shall be run concealed wherever possible. Use of surface metal raceway or exposed conduits will be permitted only where approved by the Architect/Engineer and as specifically indicated on the drawings.

3.04 WORK IN EXISTING BUILDINGS

- A. The Owner will provide access to existing buildings as required. However, this contractor, once work is started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.
- B. Adequately protect and preserve all existing and newly installed work. Promptly repair any damage to same at this contractor's expense.
- C. Consult with the Owner's representative as to the methods of carrying on the work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all telecommunications services shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's representative.

3.05 COORDINATION

- A. Install work to avoid interference with work of other trades including, but not limited to, architectural, mechanical and electrical trades. Remove and relocate any work that causes interference at this contractor's expense. Disputes regarding the cause of interference will be resolved by the Owner's representative or Architect/Engineer.
- B. If there is a general contractor, the general contractor is responsible for the construction schedule. All work activities are to be coordinated with the general contractor.

3.06 CHASES AND RECESSES

- A. Chases and recesses shall be provided by the Architectural Trades, but this contractor shall be responsible for coordinating their accurate location and size.

3.07 SLEEVES

- A. Provide and install Hilti Speed Sleeve model CP-630 or EZ path fire stop system wherever conduits or cabling pass through fire rated walls, floors or cables pass through openings in walls.

3.08 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

- A. Refer to General Conditions for requirements.
- B. All cutting, patching and repair work shall be done by the Contractor.

3.09 ACCESS DOORS

- A. Provide access doors for installation by architectural trades. In the walls, provide Milcor No. "DW" or "M" as required to make all controls, electrical boxes and other equipment installed by the contractor accessible. Minimum size 12 inches x 12 inches. In the ceiling, provide Milcor No. 3210, 3105 or 3206 for accessibility as mentioned above, 24 inches x 24 inches minimum size. The plaster or

acoustical tile insert shall be by the architectural trades. Areas with accessible ceilings (ceilings where tiles are not fastened in place and can be individually removed without removal of adjacent tiles) will not require access doors.

- B. When access doors are in fire resistant wall or ceilings, they must bear the Underwriters Laboratories, Inc., Label, with time design rating equal to or exceeding that of the wall or ceiling unless they were a part of the tested assembly.

3.10 CLEANING

- A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.
- B. Final cleanup shall include, but not be limited to, cleaning all telecommunications equipment spaces, devices, cover plates, and removing all scrap cable and debris from pathways.

3.11 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

- A. Equipment and materials shall be protected from theft, injury or damage.
- B. Protect conduit openings with temporary plugs or caps.
- C. Provide adequate storage for all equipment and materials delivered to the job site. Location of the space will be designated by the Owner's representative or Architect. Equipment set in place in unprotected areas must be provided with temporary protection.

3.12 EXTRA WORK

- A. For any extra telecommunications work that may be proposed, this contractor shall furnish to the General Contractor, an itemized breakdown of the estimated cost of the materials and labor required to complete this work. This contractor shall proceed only after receiving a written order from the General Contractor establishing the agreed price and describing the work to be done.

3.13 DRAWINGS AND MEASUREMENTS

- A. These Specifications and accompanying drawings are intended to describe and provide for finished work. They are intended to be cooperative, and what is called for by either shall be as binding as if call for by both. The Contractor will understand that the work herein described shall be complete in every detail.
- B. The drawings are not intended to be scaled for rough-in measurements or to serve as Shop Drawings. Field measurements, necessary for ordering materials and fitting the installation to the building construction and arrangement, shall be taken by this contractor.

3.14 AUTOMATION SYSTEM PROGRAM CODE

- A. All automation system uncompiled and compiled program codes, source codes, custom modules, graphical user interface screen shots and any other automation system programming data and material (Program Code) shall be provided to the UNIVERSITY in hard copy and on CD Rom in an unencrypted format acceptable to the UNIVERSITY.
- B. Copyright for the Program Code shall be assigned to the UNIVERSITY for purposes of system maintenance.
- C. Provision of and Copyright assignment of the Program Code to the UNIVERSITY by the Vendor shall be conditions of the Purchase Order and contract acceptance by the Vendor.
- D. Provision of and Copyright assignment of the Program Code to the UNIVERSITY by the Vendor shall be conditions of final System acceptance by the UNIVERSITY.

END OF SECTION 27 05 00

SECTION 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS.....	1
1.02 SUMMARY	1
1.03 DEFINITIONS	2
1.04 HORIZONTAL CABLING DESCRIPTION.....	2
1.05 PERFORMANCE REQUIREMENTS	2
1.06 SUBMITTALS	2
1.07 WARRANTY	3
1.08 QUALITY ASSURANCE.....	3
1.09 DELIVERY, STORAGE, AND HANDLING.....	4
1.10 PROJECT CONDITIONS	4
1.11 COORDINATION.....	4
1.12 EXTRA MATERIALS	4
PART 2 PRODUCTS	4
2.01 PATHWAYS	4
2.02 UTP CABLING SYSTEM WARRANTY	5
2.03 COPPER HORIZONTAL CABLING	5
2.04 UTP JACKS AND CONNECTORS	5
2.05 UTP PATCH PANELS	6
2.06 FACE PLATES	6
2.07 UTP PATCH CORDS	6
2.08 GROUNDING	7
2.09 IDENTIFICATION PRODUCTS.....	7
2.10 SOURCE QUALITY CONTROL	7
PART 3 EXECUTION.....	7
3.01 WIRING METHODS	7
3.02 INSTALLATION OF PATHWAYS.....	7
3.03 INSTALLATION OF CABLES.....	8
3.04 FIRESTOPPING.....	9
3.05 GROUNDING	9
3.06 IDENTIFICATION.....	9
3.07 FIELD QUALITY CONTROL	10
3.08 DEMONSTRATION.....	11

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Refer to the Wayne State University Standards for Communications Infrastructure found at: <https://tech.wayne.edu/docs/wsu-communications-standards.pdf>. The Wayne State University Standards for Communications Infrastructure shall supplement these specifications. In the event of inconsistencies or disagreement within the Division 27 specifications and the Wayne State University Standards for Communications Infrastructure, the Wayne State University Standards for Communications Infrastructure shall override the Division 27 specifications.

1.02 SUMMARY

- A. Section Includes:
 1. Pathways.
 2. UTP cabling.
 3. Multiuser telecommunications outlet assemblies.
 4. Cable connecting hardware, patch panels, and cross-connects.
 5. Telecommunications outlet/connectors.

6. Cabling system identification products.
 7. Cable management system.
- B. Related Sections:
1. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.03 DEFINITIONS

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. BICSI: Building Industry Consulting Service International.
- C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.
- D. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- F. EMI: Electromagnetic interference.
- G. IDC: Insulation displacement connector.
- H. LAN: Local area network.
- I. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.
- J. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- K. RCDD: Registered Communications Distribution Designer.
- L. UTP: Unshielded twisted pair.

1.04 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
 1. TIA/EIA-568-C.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
 2. Horizontal cabling shall contain no transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 3. Bridged taps and splices shall not be installed in the horizontal cabling.
 4. Splitters shall not be installed as part of the optical fiber cabling.
- B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

1.05 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-C.1, when tested according to test procedures of this standard.

1.06 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 3. Cabling administration drawings and printouts.
 4. Wiring diagrams to show typical wiring schematics, including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
 5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
- C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Maintenance Data: For splices and connectors to include in maintenance manuals.
- G. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.

1.07 WARRANTY

- A. General
1. The cabling system shall be warranted by the manufacturer(s) of the components for a period of not less than 20 years from the time the installation is deemed complete.
 2. It shall be the sole responsibility of the Contractor to register the project with the manufacturer(s) and meet all manufacturers' warranty requirements.
 3. Contractor shall provide Owner with all manufacturers' warranty certificates with Record Documents.
- B. Warranty Coverage
1. Product - all passive components of the cabling system shall be warranted to be free from defects in material and workmanship.
 2. Performance - all passive components, as installed, shall be warranted to exceed TIA and ISO performance specifications for Permanent Link and Channel, as required, at all frequencies specified and shall meet or exceed all manufacturer's published performance data.
 3. Applications - the installed Permanent Link and Channel shall be warranted to support all current applications, as well as those introduced in the future, that require the specified cabling system per TIA and ISO specifications.
- C. Warranty Requirements
1. Provide a Channel Permanent Link warranty for all data drops.
 2. Warranty shall cover repair or replacement of all defective components free of charge, including all labor performed by a manufacturer-certified installer. All replacements components shall be furnished new. No used, reconditioned, or refurbished components shall be allowed.
 3. The installing contractor shall be certified by the cabling and connector manufacturers as an approved and trained installer of their equipment. Submit letter of certification from the manufacturer to the engineer at time of submittal. No exception to this will be allowed

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: An NRTL.
1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 50 or less.
- 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.
- E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- F. Grounding: Comply with ANSI-J-STD-607-A.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
1. Test each pair of UTP cable for open and short circuits.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.12 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. Patch-Panel Units: One of each type.
 2. Connecting Blocks: One of each type.
 3. Device Plates: One of each type.
 4. Multiuser Telecommunications Outlet Assemblies: One of each type.

PART 2 PRODUCTS

2.01 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
1. Support brackets with cable tie slots for fastening cable ties to brackets.
 2. Lacing bars, spools, J-hooks, and D-rings.
 3. Straps and other devices.
- C. Cable Tray Requirements

1. Refer to Division 26 section "Cable Trays" for cable tray intended to support backbone cabling.
- D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceways and Boxes."
Flexible metal conduit shall not be used.
 1. Outlet boxes shall be no smaller than 4 inches wide, 4 inches high, and 2-1/2 inches deep.

2.02 UTP CABLING SYSTEM WARRANTY

- A. General
 1. The UTP voice and data cabling system shall be warranted by the manufacturer(s) of the components for a period of not less than 20 years from the time the installation is deemed complete.
 2. It shall be the sole responsibility of the low voltage cabling Contractor to register the project with the manufacturer(s) and meet all manufacturers' warranty requirements.
 3. It shall be the sole responsibility of the low voltage cabling Contractor shall provide Owner with test results, all manufacturers' warranty certificates with Record Documents including a site plan elevation with outside plant man holes, hand holes & conduit.

2.03 COPPER HORIZONTAL CABLING

- A. Manufacturers:
 1. CommScope
 2. BerkTek-Ortronics
 3. Superior-Essex
 4. Hubbell
 5. Beldon
- B. Description:
 1. Horizontal cable shall be furnished with performance requirements for the system served (voice, video or data) as indicated on the drawings riser diagram.
 2. Category 6 enhanced: 23 AWG, 4-pair, 100 ohm, UTP,, with green jacket for data & wireless access points, purple jacket for security camera cabling.
 3. Workstation, server, printer etc. data jacks will terminate in their own group of patch panels installed in equipment racks. Wireless access point & security camera data jacks will terminate in their own separate group of patch panels installed in the equipment racks.

2.04 UTP JACKS AND CONNECTORS

- A. Manufacturers:
 1. CommScope UNJ600.
 2. Ortronics
 3. Leviton
 4. Hubbell
 5. Beldon
- B. Modular jacks for UTP cables:
 1. 8 position, 8 conductor, non-keyed, universal modular jack, snap-in type, terminated with a 110 style pc board connector, color coded for T568A & T568B wiring.
 2. Designed to terminate 22-26 AWG solid on insulation-displacement 110-style connectors.
 3. Contacts shall be minimum 50 micron gold-plated in the contact area.
 4. Rated to match the performance of the cabling system they are installed on.
 5. Color coded for system served as indicated on the Drawings.
 6. Furnish keystones (icons) for jack identification. Keystones for voice jacks shall be White and keystones for data, wireless access points & security cameras jacks shall be orange.
 7. When installing outdoor cameras, Aps, or any type of network device you must use one of the following Hi-Impact jacks and patch cords.
 - a. Manufacturers:
 - 1) CommScope UMP610-24P or UMP610-48P.

- 2) Ortronics
 - 3) Leviton
 - 4) Hubbell HI6Coupler & Jack. HI603AE Patch Cord
 - 5) Beldon
8. When installing outdoor cameras, Aps, or any type of network device you must use one of the following CAT6E POE compatible lightning Surge protection devices part of the communication room termination.
 - a. Manufacturers:
 - 1) ATLAN AT-2210
 - 2) Phoenix Contact DT-LAN-CAT.6+ 2281007
 - 3) L-COM BT-CAT6-P1-HP

2.05 UTP PATCH PANELS

- A. Manufacturers:
 1. CommScope UMP610-24P or UMP610-48P.
 2. Ortronics
 3. Leviton
 4. Hubbell
 5. Beldon
- B. UTP Patch Panel:
 1. Patch panel shall serve as data jack, security camera and wireless access point system horizontal cross connect.
 2. Wireless access point & security camera data jacks will be terminated on their own patch panel separate from the workstation data jack patch panels.
 3. Patch panel shall be configured for standard 19" rack mounting.
 4. High density type with 24 modular jack ports for every standard rack mount unit (1.75" high).
 5. Maximum 6 port groupings of replaceable modules.
 6. Terminations for the "building side" cabling on 110-style insulation pc board connectors color-coded for T568B terminations.
 7. Horizontal and vertical cable management hardware front and rear.
 8. Performance shall meet the performance of the cabling system they are installed on.
 9. Constructed of black anodized aluminum with adequate structural integrity so that panel will not deflect when center of panel is pushed with the hand.
 10. Provisions for icons and labeling to comply with the labeling requirements in specification 17170, "Cable Plant Administration and Testing".

2.06 FACE PLATES

- A. Manufacturers: Same as jacks and connectors, unless otherwise noted. In almost all cases in labs, stainless steel plates will be called out in lieu of plastic. Reference construction drawings.
- B. Face plates for wall mounted workstation outlets shall allow a minimum 2 and maximum of 6 positions and accept snap-in jacks, as specified.
- C. Face plates for recessed outlet boxes shall be high-strength nylon, white color, single-or double-gang as required and as applicable. Face plates shall be equipped with label slots, top and bottom, and clear polycarbonate covers for each label.
- D. Provide duplex mounting frames, as required, to mate and match jacks to face plates.
- E. Provide stainless steel faceplates with attachment hooks for hanging telephone device for outlets indicated as wall phone outlets.

2.07 UTP PATCH CORDS

- A. Manufacturers:
 1. Shall be the same manufacturer & type as the cable, jacks & patch panels installed in the building.
- B. Description:

1. Provide two (2) patch cords, one of each length specified, for each data port in patch panel outlet and one (1) patch cord for each data port for the workstation, length as specified above.
2. For the communication room side provide 24 AWG, 4-pair, 100 Ohm, solid, UTP patch cords of similar construction, impedance-matched, having compatible performance as copper UTP horizontal and fully warranted, as required.
3. For the workstation room side provide cords with stranded conductors and jacketing for greater flexibility, having compatible performance as copper UTP horizontal and fully warranted, as required.
4. Patch cords shall be 10'-15' in length, gray color for the workstation, 3'-7' in length, gray color for the communication room, 1' in length, green color for the access point & 3' in length, purple color for the security cameras. Coordinate possible different lengths with Owner.

2.08 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.09 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Electrical Identification."

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-C.1.
- C. Factory test UTP cables according to TIA/EIA-568-C.2.
- D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-C.3.
- E. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- F. Cable will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

PART 3 EXECUTION

3.01 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceways and Boxes."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.02 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Division 26 Section "Raceways and Boxes" for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard when entering room from overhead.
 - 4. Extend conduits 3 inches above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.03 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-C.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. MUTOA shall not be used as a cross-connect point.
 - 5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for UTP at least 49 feet from communications equipment room.
 - 6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - 10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - 12. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
 - 13. At the work area outlet, provide a 12-inch slack loop in each cable.
 - 14. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

- C. UTP Cable Installation:
 - 1. Comply with TIA/EIA-568-B.2.
 - 2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.
- D. Group connecting hardware for cables into separate logical fields.
- E. Separation from EMI Sources:
 - 1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
 - 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
 - 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
 - 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
 - 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.04 FIRESTOPPING

- A. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.05 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.06 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Electrical Identification."
 - 1. Administration Class: 1.
 - 2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

- B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
- C. Comply with requirements in Division 9 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.
- E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- G. Cable and Wire Identification:
 - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
 - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
 - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
 - 6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
- H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
 - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.07 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. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - 2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.

3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 5. UTP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.
 6. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
 - a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
 - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.08 DEMONSTRATION

- A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets. Include training in cabling administration software.

END OF SECTION 27 15 00

SECTION 28 10 00 - ELECTRONIC ACCESS CONTROL AND INTRUSION DETECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, and Division 1 Specifications Sections, apply to this Section.

1.02 DESCRIPTION OF WORK

- A. Extent of Electronic Access Control and Intrusion Detection work is listed on drawings and schedules and may include:
- | | |
|--|--|
| 1. ADA Operators – LCN | 18. Marker Strip – Cinch |
| 2. ADA Actuators – LCN | 19. Power Controllers – Altronix |
| 3. Batteries – JCI | 20. Power Supply (Glassbreak) – Altronix |
| 4. Card Readers – CBORD | 21. Power Supply (Access) – CBORD |
| 5. Card Readers – Mercury | 22. Power Supply (Lock) – CBORD |
| 6. Connectors – Molex | 23. Power Supply (Lock) – Von |
| 7. Controller – CBORD | 24. Power Transfers – Von |
| 8. Cylinder – Best | 25. Relay – Moose |
| 9. Electric Hinges – Hager | 26. Relay – Omron |
| 10. Electrified Exit Devices – Von | 27. Relay Sockets – Omron |
| 11. Electrified Mortise Lock – Corbin | 28. Tamper Switches – GE |
| 12. Enclosure – CBORD | 29. Terminal Board – CBORD |
| 13. Enclosure – Hoffman | 30. Terminal Board – JCI |
| 14. Enclosure – JCI | 31. Terminal Panel – Hoffman |
| 15. Glass Break Detectors – Intellisense | 32. Terminal Strip – Cinch |
| 16. Key Switch – Alarm Control | 33. Transformer – JCI |
| 17. Magnetic Door Contact – GE | |
- B. Provide all components and work as shown in the specifications and drawings, and also include all necessary components not listed as may be required to provide the required system operation.
- C. Coordinating with WSU One Card Office representative for all programming and configuration of interior card reader door.
- D. Coordinating with WSU One Card Office representative for system turn on and test. Compile checklist to verify that all devices have been installed, terminated, tested and report properly to WSU One Card Office CBORD system computer.
- E. Coordinating with GC representative for new key core installations on all exit door hardware
- F. Coordinating with the WSU-DPS for programming of all access control and alarm monitoring input points and output points onto P2000 Access Control and Alarm Monitoring System server.

- G. Door hardware listed in this section but noted as 08 71 00 is shown for door operation clarity only and is not to be included in this bid.
- H. Termination of electrified door hardware shall be by security contractor with cost included under this section.

1.03 RELATED SECTIONS / WORK

- A. Section 08 71 00 – Finish Hardware
- B. Section 08 80 00 – Glazing
- C. Section 27 11 00 – Basic Voice & Data Systems
- D. Section 27 13 00 – Backbone and Horizontal Cabling for Voice & Data Systems
- E. Refer to Division 26 Sections for Electrical work. All conduits, conduit pull strings, back boxes and 120VAC shall be provided and installed by electrical contract as indicated on security drawings. Equipment cabinets shall be provided by security contractor and installed by electrical contractor as indicated on security drawings.
- F. WSU Department of Public Safety will provide administrative access rights to the JCI P2000 Access Control System Server for all control panel configurations and programming including perimeter card access, perimeter door control, input x output control and intrusion alarm programming. Contact Lt. Robert Barron @ (313) 577-6059 for assistance.
- G. Carpentry Contractor shall install final key cores at all emergency exit Chexit devices, emergency exit alarmed exit devices and all required locking hardware locations. It is the Security Contractor's responsibility to coordinate the installation of all key cores with the GC project manager assigned to this project.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with the conditions of Contract and Division 1 Specification Sections.
- B. Product Data: Submit manufacturer's specifications and installation instructions for types of security equipment indicated.
- C. Templates: All electric hardware to be applied to metal door frames shall be made to template and packed with machine screws. Forward mortise hardware to the plant of the door manufacturer for application there if required and provide necessary templates promptly upon receipt of frame shop drawings.
- D. Schedule: After formal notice of award, prepare a security schedule setting forth the items proposed to be furnished for every opening and device group. Submit proper number of copies of this schedule to allow the architect to retain two copies, and to furnish one copy for the owner, plus the number of copies required by the design / builder for its distribution and use (10 copies max.) The schedule shall be written in the exact format as the specification wherein the information shall provide an opening / device location description, and shall state the name of the manufacturer, and type, number and finish of each device proposed to be used.

Type the security schedule double spaced and submits on 8½ x 11 inch sheets of paper. Submittals not following this format will be returned unchecked.

- E. Shop drawings: Submit ten copies of shop drawings which include riser and wiring diagrams and other information and details required for coordinated installation with other related work.

Drawings shall be identical versions of security drawings pertaining to this section with changes and additional details and shall include the following at a minimum.

- Floor plans showing door and device locations produced on AutoCAD 2016 and in an acceptable manner.
- Riser diagrams produced on AutoCAD 2016 showing proposed cable runs from each door device with cable manufacturer, cable description and outside diameter clearly marked.
- Wiring diagrams produced on AutoCAD 2016 showing all devices in system with point to point wiring between every device.
- All drawings shall be professionally and clearly produced using AutoCAD 2008 or they will be returned unchecked.

1.05 AS BUILT DRAWINGS

- A. Assemble three as built job binders, indexed with the following as built information.

Index 1 "Security Schedule": Copy of security schedule similar to submittal schedule but revised to indicate as built material listing.

Index 2 "Data Sheets / Manuals": Copy of all data sheets and / or manuals for all devices listed in security schedule.

Index 3 "Configuration Sheets": Copy of configuration sheets showing all system program information relative to this project.

Index 4 "Floor Plans": Copy of security floor plans similar to the submittal floor plans but revised to indicate as built conditions.

Index 5 "Riser Diagrams": Copy of riser diagrams similar to submittal riser diagrams but revised to indicate as built conditions.

Index 6 "Wiring Diagrams": Copy of wiring diagrams showing all devices in system with point to point wiring between every device.

1.06 QUALITY ASSURANCE

- A. General: Electronic Access Control and Intrusion Detection systems shall be provided by Electronic Security Systems, Inc. or a security systems integrator who meets the following requirements:

1. Must be able to show evidence of past experience furnishing and servicing door locking hardware and electronic systems specified in this section.
2. Meet all applicable licensing and regulatory requirements of the State of Michigan, particularly Public Act 330.
3. Meet all applicable local jurisdiction licensing requirements.
4. Must have been engaged in the business of providing, installing, servicing and maintaining similar security measures in similar environments during the past five (5) years.
5. Must have a local support capacity consistent with the demands of this project and other local clients.
6. To ensure the Security Systems Integrator is properly trained and knowledgeable of the system products they must be a factory direct authorized dealer and certified for all products and equipment specified in this section. Equipment procured through wholesale houses, distributors or non factory authorized security integrator will be disqualified.
7. Must have a properly staffed facility with a properly stocked equipment warehouse within a four (4) hour drive of the job site.
8. Electronic Access Control and Intrusion Detection Systems Contractor must be a member of local 58 or pay their employees prevailing wages to avoid job delays. Subcontract work will not be accepted.
9. Insurance and Indemnity: The contractor shall take out and maintain, during the life of this agreement insurance coverage's as set forth by the owner.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver equipment to job site unless otherwise required or directed, wrapped in separate packages, complete with all the trimmings and screws for each door, labeled and numbered for each opening.
- B. Furnish typewritten schedule with each shipment in conformity with approved schedule. Furnish receipts in duplicate, upon delivery of hardware to the project site.

PART 2 – PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. Manufacturers for material, in accordance with the requirements of this Section are as follows, no substitutions allowed. This list defines the manufacturer only and does not in any way act to permit any deviation from the requirements of the Contract Documents.
- B.
 1. Key Switch
 2. Power Supply (Glassbreak)
 3. Power Supply (Lock)
 4. Power Controllers
 5. IC Cylinder Housings
 6. Card Readers
 7. Controller (Access)

Alarm Controls
Altronix
Altronix
Altronix
Best
CBORD
CBORD

8. Enclosure	CBORD
9. Power Supply (Access)	CBORD
10. Power Supply (Lock)	CBORD
11. Terminal Strips	Cinch
12. Marker Strips	Cinch
13. Armor Door Loop	Command Access
14. Electrified Mortise Lock	Corbin
15. Magnetic Door Contact	GE / Sentrol
16. Tamper Switch	GE / Sentrol
17. Gate Contact	GRI
18. Electric Hinge	Hager
19. Enclosures	Hoffman
20. Panels	Hoffman
21. Glassbreak Detectors	Intellisense
22. Batteries	JCI
23. Enclosures	JCI
24. Terminal Boards	JCI
25. Transformer	JCI
26. ADA Actuators	LCN
27. ADA Operators	LCN
28. Bollard Post	LCN
29. Card Reader	Mercury
30. Relays	Moose
31. Relays	Omron
32. Relay Sockets	Omron
33. Custom Back Boxes	Stellar Plastics
34. Electric Exit Devices	Von Duprin
35. Power Supply (Exit Devices)	Von Duprin
36. Power Transfer	Von Duprin
37. Connectors – Multi	Waldom Molex

2.02 ELECTRONIC ACCESS CONTROL AND INTRUSION DETECTION SYSTEMS EQUIPMENT SUPPLIER CODES

1. CBORD = WSU Internal Access Control System
2. EACAIDS = Electronic Access Control and Intrusion Detection Systems, Section and or Contractor
3. Existing = Existing equipment / hardware to remain
4. IAP = Intrusion Alarm Panels.
5. IACP = Interior Access Control Processor and Associated Terminal Panels and Power Supplies (CBORD)
6. PACP = Perimeter Access Control Processor and Associated Terminal Panels and Power Supplies (JCI)
7. WSU-DS = Wayne State University Design Services
8. WSU-DPS = Wayne State University Department of Public Safety
9. WSU-OCO = Wayne State University One Card Office
10. 08 71 00 = Hardware supplied by finish hardware contractor and installed by carpentry contractor
11. 26 00 00 = Division 26 00 00 is related to all electrical sections.
12. 28 10 00 = Equipment supplied and installed by (EACIDS) Electronic Access Control and Intrusion Detection systems Contractor

2.03 ELECTRONIC ACCESS CONTROL AND INTRUSION DETECTION SYSTEMS EQUIPMENT SETS

***ALTERNATE NO.1**

Security Set SS-A

Perimeter Single Door with Card Reader & Monitoring

Single Door 125 Exterior from Lounge 125 (**HDW Set 2.0**)
(1) 3'-0" x 6'-8" x 1 3/4" x WD x ALUM

LHR

24 Hour Mode: Door Held Locked by PACP / Card x PIN Required Entry / No Key Override / REX
Detected Manual Free Egress / Door Position, Latch Bolt and Device Tamper Monitored
through JCI P2000 Access Control System by WSU-DPS

<u>Item</u>	<u>Division Section</u>	<u>Qty</u>	<u>Description</u>
1.	08 71 00	1	Continuous Hinge PE # CFM-SLF-HD1-PT
2.	08 71 00	1	Rim Cylinder BE # 1E72x626
3.	08 71 00	1	Pull RO # RM201 MTG-TYPE 12xHD
4.	08 71 00	1	Concealed Overhead Stop RF # 6-X36 630
5.	08 71 00	1	Surface Closer LCN # 4040XP-ALUM (Top Jamb Mount x Mtg. Plate As Appropriate
6.	08 71 00	1	kick Plate / Door Seals / Threshold / Door Sweep
7.	OWNER	1	Final Core Best
8.	28 10 00	1	Electric Power Transfers VON # EPT-10 x 689
9.	28 10 00	1	Electric Mortise Lock SCH # L9092BD-EU-03B-626-RX-LX-LH
10.	28 10 00	1	Power Supply VON # PS902-2RS
11.	28 10 00	1	Door Contact GE # 1076D
12.	28 10 00	1	Card Reader Mercury # BR-2012T3
13.	28 10 00	1	Custom Reader Head Box w/ Rain Hood Stellar (Verify Field Conditions and Coordinate with Architect & Owner)
14.	28 10 00	1	Reader Tamper Switch GE # 1035
15.	28 10 00	1	Power Supply Tamper # GE 30121
16.	28 10 00	1	EPT Connectors (See Exhibit "B" Section 5.02 A.3. of this document for details)
17.	28 10 00	Lot	Mounting Hardware / J-Hooks / Fire Stop
18.	28 10 00	Lot	Cabling (As Indicated on Security Riser Diagram)
19.	28 10 00	Lot	Labor to mark up and deliver power supply to electrical contractor for coordinate and installation. Install j-hooks, back boxes, cabling and fire stop. Fish cables to device locations. Deliver install and terminate EPT, exit device, power supply, reader shroud, card reader, door contact, tamper switch, Molex connector and all associated hardware. Terminate control panel. Turn on program and test. Perform final adjustments.

***CONDUIT, BACK BOXES AND PULL STRINGS SHALL BE PROVIDING AND INSTALL BY DIVISION 16 AND
SHALL BE INCLUDED AS BASE BID. PROVIDE ALTERNATE PRICE FOR ABOVE MATERIAL & LABOR.**

Security Set SS-B

Single Door Exterior w/ with TD Egress / Card Reader In & Out / Monitoring

Single Door 130A Exterior form Lobby 130 (**HDW Set 1.0**)
 (1) 3'-0" x 6'-8" x 1 3/4" x GL/AL x GL/AL

RH

24 Hour Mode: Door held Locked by PACP / Card x PIN Required Entry / Card Required Egress / No Keyed Entry Override / Door Position, Latch Bolt and Device Tamper Monitored through JCI P2000 Access Control System by WSU-DPS

Emergency Mode: Pressing On Exit Device Will Sound Local Alarm, Door Will Unlock for Egress after a 15 Second Delay / TD Initiate Monitored Remotely via JCI P2000 Access Control System by WSU-DPS / TD Initiate Monitored Locally via Annunciator at Reception Desk / TD Disabled and Door unlocks upon Fire Alarm Activation or Power Loss

<u>Item</u>	<u>Division Section</u>	<u>Qty</u>	<u>Description</u>
1.	08 71 00	1	Full Surface Continuous Hinge
2.	08 71 00	1	Mortise Cylinder
3.	08 71 00	1	Final Cores
4.	08 71 00	1	Surface Closer
5.	08 71 00	1	Door Seals / Threshold / Door Sweep
	Existing*	1	Electric Power Transfers VON # EPT-10 x 689
6.	Existing*	1	Electric Exit Devices VON # WP-RX98L x US28 x 3'
7.	Existing*	1	Mortise Cylinder SCH # 80-102 x 626
8.	Existing*	1	Latch Bolt Monitor Strike VON # 4268-T1
9.	Existing*	1	Time Delay Module VON # DE5101
10.	Existing*	1	Magnetic Lock SES # M450P x TJ450 x Alum.
11.	Existing*	1	Card Reader Mercury # BR-2012T3
12.	Existing*	1	Card Reader Mercury # MR-1012T3
13.	Existing*	1	Reader Mounting Plate Mercury # WP10
14.	Existing*	1	Custom Reader Head Box w/ Rain Hood Stellar # XXX
15.	Existing*	1	Reader Tamper Switch GE # 1035
16.	Existing*	1	Power Supply Tamper # GE 3012
17.	Existing*	1	3 Gang x 2" D Wiremold Back Box
18.	Existing**	Lot	Cabling
19.	28 10 00	1	Door Contact GE # 1076D
20.	28 10 00	1	EPT Connector (See Exhibit "B" Section 5.02 A.3. of this document for details)
21.	28 10 00	Lot	Mounting Hardware / J-Hooks / Fire Stop
22.	28 10 00	Lot	Labor as follows: <ul style="list-style-type: none"> • Power down, disconnect and removes existing hardware as listed above. • Store hardware off site in a secured location. • Pull all cables out of wall & door frame. • Securely store cabling above ceiling for re-use at later date. • Clearly identify cabling as "<u>SECURITY CABLING FOR DOOR 130A</u>" every 5'. • Fish cables to device locations after new door and frame are installed. • Deliver and install EPT, exit device, door contact, magnetic lock, monitored strike, TD module back box, and reader mounting plate, reader rain hood, card reader, tamper switch, Molex connector and all associated hardware. • Terminate field device, terminal cabinet, control panel and power supply. • Turn on program and test. • Perform final adjustments.

*** Existing hardware to be disconnected, removed and stored off site in secured location. Existing hardware shall be re-installed after installation of new door and frame. Security vendor to coordinate hardware preparations with glazing contractor to ensure proper hardware installation**

**** Existing cabling to be removed from existing door frame and securely stowed above ceiling. Existing cabling to be clearly identified as "SECURITY CABLING FOR DOOR 130A" EVERY 5'**

Security Set SS-C

Perimeter Single Door with Card Reader & Monitoring

Single Door 177B Exterior from Staff Lounge 177 (HDW Set 2.0)
(1) 3'-0" x 6'-8" x 1 3/4" x WD x ALUM

RHR

24 Hour Mode: Door Held Locked by PACP / Card x PIN Required Entry / No Key Override / REX
Detected Manual Free Egress / Door Position, Latch Bolt and Device Tamper Monitored
through JCI P2000 Access Control System by WSU-DPS

<u>Item</u>	<u>Division Section</u>	<u>Qty</u>	<u>Description</u>
1.	08 71 00	1	Continuous Hinge PE # CFM-SLF-HD1-PT
2.	08 71 00	1	Rim Cylinder BE # 1E72x626
3.	08 71 00	1	Pull RO # RM201 MTG-TYPE 12xHD
4.	08 71 00	1	Concealed Overhead Stop RF # 6-X36 630
5.	08 71 00	1	Surface Closer LCN # 4040XP-ALUM (Top Jamb Mount x Mtg. Plate As Appropriate)
1.	08 71 00	1	kick Plate / Door Seals / Threshold / Door Sweep
2.	Existing*	1	Electric Power Transfers VON # EPT-10 x 689
3.	Existing*	1	Electric Exit Devices VON # EL-LXRRLC-98DT x 626 x 3'
4.	Existing*	1	Power Supply VON # PS914-2RS
5.	Existing*	1	Card Reader Mercury # BR-2012T3
6.	Existing*	1	Custom Reader Head Box w/ Rain Hood Stellar # XXX
7.	Existing*	1	Reader Tamper Switch GE # 1035
8.	Existing*	1	Power Supply Tamper # GE 30121
9.	Existing**	Lot	Cabling
10.	28 10 00	1	EPT Connectors (See Exhibit "B" Section 5.02A A.3. of this document for details)
11.	28 10 00	1	Door Contact GE # 1076D
12.	28 10 00	Lot	Mounting Hardware / J-Hooks / Fire Stop
13.	28 10 00	Lot	Labor as follows: <ul style="list-style-type: none"> • Power down, disconnect and removes existing hardware as listed above. • Store hardware off site in a secured location. • Pull all cables out of wall & door frame. • Securely store cabling above ceiling for re-use at later date. • Clearly identify cabling as "<u>SECURITY CABLING FOR DOOR 177B</u>" every 5'. • Fish cables to device locations after new door and frame are installed. • Deliver and install EPT, exit device, door contact, and reader mounting plate, reader rain hood, card reader, tamper switch, Molex connector and all associated hardware. • Terminate field device, terminal cabinet, control panel and power supply.

- Turn on program and test.
- Perform final adjustments.

***EXISTING HARDWARE TO BE DISCONNECTED, REMOVED AND STORED OFF SET IN SECURED LOCATION. EXISTING HARDWARE TO BE RE-INSTALLED AFTER INSTALLATION OF NEW DOOR AND FRAME. SECURITY VENDOR TO COORDINATE HARDWARE PREPARATIONS WITH GLAZING CONTRACTOR TO ENSURE PROPER HARDWARE INSTALLATION**

**** EXISTING CABLING TO BE REMOVED FROM EXISTING DOOR FRAME AND SECURELY STOWED ABOVE CEILING. EXISTING CABLING TO BE CLEARLY IDENTIFIED AS "SECURITY CABLING FOR DOOR 177B" EVERY 5'**

Security Set SS-1

PIAP (Perimeter Intrusion Alarm Processor)

Building Perimeter (Doors and Windows)

PIAP-Located 2nd Fl. MDF Closet 243.2

Operation: System Auto Armed x Disarmed by Scheduled Time Zone from P2000 Access Control System / Perimeter Glass Monitored / Glassbreak Detectors and Keypads Tamper Monitored / Multiple Zone Group Reporting to WSU police Dispatch / Local Individual Zone Verification via LCD Keypad at West Entrance Stairwell and Reception Desk

***Existing Glassbreak Sensors: GB1 – GB30**

Existing Monitored Doors: 130A, 177B, 190.03, 190.08A, 190.12 & Roof Hatch
**** NEW Monitored Door: 125**

<u>Item</u>	<u>Division Section</u>	<u>Qty</u>	<u>Description</u>
1.	Existing	1	Controller Honeywell VISTA128/PAK1
2.	Existing	1	Alarm Keypads Honeywell # 6160
3.	Existing	6	Relay Module Honeywell 4204
4.	Existing	30	Glass Break Detectors Honeywell FG1625SN
5.	Existing	1	V-Plex Loop Extender Honeywell 4297
6.	Existing	1	V-Plex 2 Zone Transponders Honeywell # 4191SN
7.	Existing	2	Door Position Switches UTC # 1076
8.	Existing	2	Junction Boxes Hoffman # ASE6x6x4 (To House Transponders)
9.	Existing	3	Tamper Switches GE 30121
10.	Existing	2	Battery Yuasa NP712
11.	Existing	1	(3) Gang Wiremold Boxes 6" x 4" x 1.5"
12.	Existing	1	Terminal Cabinet Including: Enclosure Hoffman A36N30xALP Mounting Panel Hoffman A36x30xMP Tamper Switch GE 30121 Cabinet Lock CCL 15748 Terminal Strips Cinch 20-140 Marker Strips Cinch MS20-140 Relays Omron MY424VDC Relay Sockets Omron PYF14AE Timers Alarm Controls UT-1

			Relay Boards Moose MPI206
			Power Supply Altronix SMP 3
			Transformer Amseco XP2440
			Duplex Receptacle w/ cover and back box
13.	28 10 00	1	Door Position Switch UTC # 1076-M
14.	28 10 00	1	V-Plex 2 Zone Transponders Honeywell # 4191SN
15.	28 10 00	1	Junction Boxes Hoffman # ASE6x6x4 (To House Transponders)
16.	28 10 00	1	Tamper Switch UTC # 30121
17.	28 10 00	Lot	Panel Equipment
18.	28 10 00	Lot	Mounting Hardware
19.	28 10 00	Lot	Cabling (As Indicated on Riser Diagram)
20.	28 10 00	Lot	Labor as follows:
			• Install j-hooks, back boxes, cabling and fire stop.
			• Fish cables to device locations.
			• Deliver install and terminate enclosure, transponder, door contact, tamper switch, and all associated hardware.
			• Terminate control panel.
			• Turn on program and test.
			• Perform final adjustments.

*** EXISTING GLASSBREAK SENSORS GB20-GB25 & GB27-GB30 MUST BE DISCONNECTED AND REMOVED DURING DEMOLITION PHASE. GLASSBREAK SENSORS SHALL BE STORED OFF SITE IN A SECURED LOCATION. CABLE TO BE SECURELY STOWED IN CEILING SPACE AND CLEARLY IDENTIFIED AS "SECURITY CABLING FOR GBXX" EVERY 5'. SECURITY VENDOR SHALL RE-INSTALL GLASSBREAK SENSORS ON ADJACENT WALL, BACK WALL, OR SUPPENDED CEILING, SEE HONEYWELL FG1625SN GLASSBREAK SENSOR INSTALLATION MANUAL FOR MOUNTING DETAILS.**

**** DOOR 125 TO BE MONITORED BY PERIMETER INTRUSION ALARM AS BASE BID**

Security Set SS-2

PACP (Perimeter Access Control Processor)

PACP Located 2nd Fl. MDF Closet 243.2

Operation: Card Reader Interface / Door Control Interface / Perimeter Alarm Monitoring Interface / Power Fail Monitoring / Low Battery Monitoring / Communication Status Monitoring / Electric Lock Interrupt Interface to FA

***Alternate No.1**

Card Reader Door: 125

Existing Card Reader
 Doors w/Monitoring: 130A, 177B, 190.04B & 190.08A

Existing Time Controlled
 Door w/ Monitoring: 190.04A

Existing Monitored
 Doors: 190.03

Existing Monitored

Electronic Access Control
 And Intrusion Detection Systems

28 10 00 - 10

Roof Hatch: 290

Existing Courtyard Doors
 W/ Horn & Monitor: 190.12

<u>Item</u>	<u>Division Section</u>	<u>Qty</u>	<u>Description</u>
1.	Existing	1	Master Controller JCI #CK721A
2.	Existing	1	Reader Module JCI # S300-DIN-RDR8SA
3.	Existing	1	I/O Module JCI # S300-DIN-I32O16
4.	Existing	1	I/O Module JCI # S300-DIN-I8O4
5.	Existing	1	Power Supply Altronix # Maximal75E
6.	Existing	2	Power Controllers Altronix # PD8UL
7.	Existing	4	Batteries Yuasa # NP12-12
8.	Existing	1	Cabinet Lock CCL # 15748
9.	Existing	1	Cabinet Tamper Switch GE # 3012
10.	Existing	1	Cabinet Hoffman #A36N24ALP
11.	Existing	1	Mounting Panel Hoffman # A36N24MP
12.	Existing	1	Wire Trough Hoffman # A4448RT
13.	28 10 00 *	1	Dual Reader Interface Board JCI # S300-DIN-RDR2SA
14.	28 10 00	Lot	Mounting Hardware
15.	28 10 00	Lot	Cable 18-2PL (PRW)
16.	28 10 00	Lot	Cable 24-1PROBSHPL (COMM.)
17.	28 10 00	Lot	Labor as follows: <ul style="list-style-type: none"> • Assemble and wire reader board into equipment cabinet. • Run power and communication cables between. • Fish cables to device locations. • Deliver and install mounting panel, controller, terminal boards, power controllers, batteries, tamper switches, cabinet lock and all associated hardware. • Terminate and program all devices per the schematics provided by Security Consulting, Inc. • Turn on and test for proper operation. • Perform final adjustments. • Perform walk thru and test with Department of Public Safety.

***IF ALTERNATE NO.1 IS APPROVED SECURITY CONTRACTOR SHALL SUPPLY, INSTALL AND PROGRAM NEW DUAL READER BOARD INTO EXISTING EQUIPMENT CABINET. COORINATED INSTALLATION WITH WSU POLICE.**

Security Set SS-3

AVM (Audio Video Monitoring)

AVM Panel: Located Above Ceiling in Corridor 090.01 As Noted on Security Floor Plan

Projectors: 001, 005, 023 & 125

Lecture Carts: 001, 005 & 023

Operation: AV device Monitored for Tampering / AVM Panel Monitored for Tampering / All Zones are monitored 24 x 7 by WSU Police

- In the event a component must be removed for service WSU Police must be notified prior to disconnecting "Pull-Apart Switch"

<u>Item</u>	<u>Division Section</u>	<u>Qty</u>	<u>Description</u>
1.	28 10 00	1	I/O Module JCI # S300-DIN-I8O4
2.	28 10 00	1	Cabinet JCI # SEC-ENC1616WDP
3.	28 10 00	7	Paull-Apart Magnetic Contacts UTC # 1005
4.	28 10 00	1	Cabinet Tamper Switch GE # 3012
5.	28 10 00	1	Terminal Strips Cinch # 20-140 x MS20-140
6.	28 10 00	Lot	35MM DIN Rail Omron # PFP-100N
7.	28 10 00	Lot	Mounting Hardware: J-Hooks, Bridle Rings, and Fire Stop etc.
8.	28 10 00	Lot	Panel Equipment: Wire, Terminal Strips, Relays, Relay Boards, Misc. Hardware
9.	28 10 00	Lot	Cabling (As Indicated on Security Riser Diagram)
10.	28 10 00	Lot	Labor to assemble and pre-wire components onto equipment cabinet mounting panel. Run all necessary cable. Fish cables to device locations. Deliver and install AVM cabinet, mounting panel, terminal board, tamper switch, pull-apart switches and all associated hardware. Terminate field devices, input points and controller. Turn on and program input points into P2000 head end. Test for proper operation. Perform final adjustments. Perform walk thru and test with WSU Police.

Security Set SS-3

Engineering and Documentation

<u>Item</u>	<u>Division Section</u>	<u>Qty</u>	<u>Description</u>
1.	28 10 00	Lot	Labor to engineer and produce EACAIDS schedule and AutoCAD riser diagrams, floor plan layouts, and point-to-point wiring diagrams for EACAIDS system. Provide three (3) sets of "As-Built" documents of EACAIDS schedule, cut sheets, manuals, riser diagrams, floor plan layouts, and wiring diagrams. One (2) year labor and material warranty.

PART 3 – EXECUTION

3.01 SYSTEM INSTALLATION REQUIREMENTS

General: Comply with manufacturer's instructions for assembly and installation of Electronic Access Control and Intrusion Detection System, controls and accessories.

1. Assemble and prewire control boxes and other like assemblies in suppliers' shop facility and test operation. Install completed assembly in field.
2. Install door control system components in locations indicated with work plumb, level, true and straight with no distortions. Secure exposed work with security fasteners.
3. Make final electrical connections to Electronic Access Control and Intrusion Detection System components.
4. Turn on and test all system components and system as a whole.
5. Terminations: Secure all multiple termination points on terminal blocks.

6. Exposed Panels: Secure all exposed panels with tamper resistant screws. Supply owner with two (2) tools for removing all tamper-resistant hardware.
7. Electronic Equipment Enclosures: Lock all terminal enclosures located in secured and non secure areas, housing electronic components. All enclosures shall be equipped with tamper switches as indicated in the specification section 2.03
8. Field AC Power: Directly hardwire all field AC power to equipment as required.
9. Perform all work required to cut, patch and mount Electronic Access Control System hardware.
10. All wiring shall be in accordance with the manufacturer's requirements and all applicable codes and standards including WSU C&IT Standards.
11. Tie-wrap all cabling and cleanly distribute to terminal strips. Additionally, systematically and logically number and mark all cabling using vinyl wire marker; document all cabling runs, distribution, splice points and terminations on the CAD generated "As - Built" drawings.
12. Contractor to conceal all cabling in ceilings, walls, doors and side light frames where possible. All routing of surface applied raceway must be approved by the owner and painted to match surroundings.
13. Contractor to reuse cable tray raceways where applicable.
14. Identification Nameplates - The contractor shall label all control panels, terminal boxes, and major items of the installed system and/or control description and show and describe all items on the drawings. The Contractor shall provide self-adhesive (1/8" thick plastic) labels with characters sized not less than 1/4" and with a nameplate's minimum size limited to 1" x 3". The labels shall include the device identification and "Device Name". Coordinate code with cabling, as-built documentation and system programming.
15. Remove, store, protect and re-install ceiling tiles upon completion of the work. Damaged tiles shall be replaced at Contractors expense.
16. Contractor shall remove only amounts of sprayed fire proofing as necessary to install hangers and supports to complete their scope of work. Patching of fireproofing shall be the responsibility of this contractor. Contractor shall use an installer certified in the use of sprayed resistive materials and the installation shall be in accordance with specification section 078110.
17. Contractor shall provide the Owner seven (7) calendar days notice of any system tie-ins and/or any associated work on any existing Universities system to complete this scope of work. Contractor shall further abide by associated work on any existing university system to complete this scope of work. Contractor shall further abide by all owners procedures when working on existing systems. Contractor shall complete work at universities convenience.
18. Upon mobilizing, Contractor shall submit an initial master construction schedule outlining their complete scope of work. This schedule shall be based on owners sequencing, mile stone dates and schedule. Contractor shall then update/progress their schedule and be available for discussion at each weekly foreman's meeting.
19. Contractor shall provide all required fire stop systems to complete scope of work, and shall meet all requirements outlined in specification 07841 Through Penetration Fire Stop Systems. Fire taping of pipe penetrations thru non-rated and smoke walls that extend to the deck above will be by the Contractor.

20. Due to the nature of these areas, the sequence of the work must be scheduled to minimize disruptions and disturbances to the owner's operations and utilities.
21. Contractor shall be responsible for all saw cutting / core drilling, patching, and fire stopping that is required to complete their scope of work if it is not already covered in the electrical contractors section.
22. When necessary the contractor must obtain approvals, permits, and coordinate the inspection and testing of the systems with state and local governing agencies.
23. Provide all tests, data, affidavits, test results and certificates required by all governing authorities to the Design/Builder in a timely manner to facilitate Owner occupancy.
24. Contractor shall, as deemed necessary by the Owner, provide an up to date status on submittals, lead times, and expected delivery dates of the material/equipment to complete their scope of work.
25. Contractor shall be responsible for hoisting and scaffolding to complete their scope of work.
26. Contractor shall furnish access doors to be installed by others. Contractor shall, as deemed necessary by the owner, provide all necessary coordination of the installation by others.
27. This Contractor shall be responsible for his own clean-up costs and shall at all times maintain a clean and safe jobsite. Dumpsters will be provided by the General Contractor.
28. Provide and maintain an effective safety program that will be in agreement and conform to the policies in the General Contractors Health & Safety Manual for this project.
29. Contractor will promptly process the submittals to ensure timely submittal of the items in this scope of work and ordering of the same. The contractor shall comply with the attached project schedule.
30. This bidder is responsible to review the site and be familiar with all existing conditions within and around the project including local conditions and requirements.
31. This Contractor shall be responsible to coordinate all required on-site testing, inspection and quality assurance requirements. This Contractor shall be responsible for conformance to all federal and local codes, regulations, testing, and inspection requirements as required for beneficial occupancy by the Owner. Secure and provide all inspections and permits required. Complete all certification of items as specified by the Contract Specifications, and the code and governing bodies. Testing is by the Owner.

3.02 ADJUSTMENTS, CLEANING, FINISHING AND PROTECTION

- A. Clean exposed and semi-exposed surfaces. Touch-up shop applied finishes restoring damaged or soiled areas.
- B. Operate Electronic Access Control and Intrusion Detection Systems including controls through all modes of operation and make final adjustments as necessary to ensure proper functioning.
- C. Instruction: Instruct personnel in complete operation of system through all modes.

3.03 TRAINING

- A. The Contractor shall include two (4 hour) training sessions for the Owner's personnel on the operation and maintenance of the Electronic Access Control and Intrusion Detection Systems

- B. The training courses shall be taught by a qualified representative at the Owner's location.
- C. The Contractor is responsible for providing all training materials. The owner will be responsible for providing the training room facilities at the Owner's location.
- D. The Contractor shall furnish the Owner two (2) copies of all systems manuals.
- E. System manuals shall contain the system block diagram, basic system operation outline, equipment owner's manuals, test reports, equipment service and repair manuals, system layout, date of installation and contact person and phone number.

3.04 WARRANTY

- A. The Contractor shall warrant the completed system wiring and equipment to be free from inherent mechanical and electrical defects for a period of two (2) years from the date of final acceptance by the Owner.
- B. All proposed warranties shall be provided, as a minimum, from 8:00 AM – 4:30 PM Monday through Friday with response provided with four (4) business hours from the time of notification

3.05 ALTERNATE PRICING

N/A

PART 4 – Exhibits

4.1 Exhibit "A"

- A. VISIT THE FOLLOWING LINK FOR A COPY OF THE WSU STANDARDS FOR COMMUNICATIONS AND INFRASTRUCTURE

<http://computing.wayne.edu/docs/wsu-communications-standards.pdf>

4.2 Exhibit "B"

- A.

Wayne State University Police Department

Specifications & Standards for Alarm/Card Access System

This document only provides general system requirements and product standards. Every project has unique characteristics and requirements necessary to properly secure the building. Modification of submitted security system proposals may be required upon further review by the W.S.U. Police Department.

Revision date 12/11/2017

1.01 Overview

WSU Police uses JCI (Johnson Controls Inc.) Cardkey Pegasys 2000 Access Control and Alarm Monitoring software to monitor all alarms and control building access on our campus wide system. Systems at any University building on or off campus must be compatible with Pegasys 2000 and should communicate with the server at WSU Police. Currently, the compatible controller is the JCI Cardkey CK721A network controller.

2.01 System Controllers

Access Control Processor (ACP): Each building is equipped with a CK721A ACP. The ACP is the main control processor inside each building which stores all of the pertinent data for that respective building. The data includes card holders, alarm points, output control points, time schedules etc. The ACP interfaces with multiple terminal boards (e.g. reader boards, input boards, and output boards) and also communicates directly with the P2000 Server.

- A. Card reader, alarm input and output control boards will be from the JCI Cardkey S300 series of terminal boards.
- B. The S300-DIN-I8O4 or S300-DIN-I32O16 input/output boards are designed to monitor both supervised and non-supervised devices. Each board can be configured and terminated for supervision to support critical device, such as the reporting of Fire Alarm, Fire Trouble and Fire Supervisory alarms to WSU PD and should be programmed as Terminal 1 inputs 1, 2 & 3 respectively. Non-supervised devices that may be connected to these boards include but are not limited to perimeter doors, roof hatches, roof doors, environmental alarm devices, glassbreak detectors, motion detectors, water detectors etc. Each building on campus is required to have a minimum of one S300-DIN-I8O4 input board configured to report supervised alarms.
- D. The S300-DIN-I8O4 or S300-DIN-I32O16 input/output control board is also utilized to control devices remotely (e.g. unlocking perimeter doors on time schedules, resetting glass break detectors, and shunting alarm points during business hours).
- E. The S300-DIN-RDR2SA is a two-reader terminal board and is required for everyone or 2 card readers. The S300-DIN-RDR2SA is the interface between the card reader and the CK721A network controller.
- F. The S300-DIN-RDR8SA is an 8-reader board and is typically used when the number of readers for a particular building exceeds 6 readers total. The S300-DIN-RDR8SA is the interface between the card reader and the CK721A network controller.
- F. A 12v/7Ah gel cell battery must be provided with every equipment cabinet containing a power supply for controllers or terminal boards.

3.01 Communication

- A. All building security systems are to communicate to the P2000 Server via the University Fiber Optic Backbone dedicated for security. The fiber backbone is arranged in a hub and spoke configuration with (4) fiber hub locations. Each hub is associated with a number of end buildings. These buildings are equipped with single-mode fiber between the end building and the respective fiber hub. All hubs are arranged in a self-healing ring configuration utilizing single mode fiber with a primary and secondary path to WSU Police.
- B. Radiant Communications DL221-SM-RE3 fiber converters will be used and will have APC300 Backups or similar protection. The UPS will contain a 12v/7 Ah battery with Fasten connectors.
- C. Locations without University Fiber Optic Backbone, will have to communicate to the P2000 Server via a fractional T-1 line or if the location is close enough to another location with fiber connectivity then via a microwave link. Consult the WSU Police Alarm System Administrator for specifics.

4.01 Inputs and Monitoring Requirements

- A. Most University facilities are designed for authorized users to enter 24/7, therefore system design must have perimeter security using door switches shunted for request to exit (RX) and glass break protection rather than motion detection.
- B. Perimeter security will monitor all doors for both door position and latch position.

- C. Use electrified Von Duprin rim/panic device. The use of electric strikes is prohibited unless there is no other option available as these devices are not reliable over the long haul.
- D. Use RX switches mounted inside Von Duprin rim/panic device. The use of overhead motion detectors to shunt door alarms on doors is not acceptable.
- E. All security devices will be monitored for tampering, including all card readers, all alarm control keypads, all motion sensors and all glass break sensors. Tamper alarms for security devices will be wired to separate input points than their respective security device's input point.
- F. All panels and equipment cabinets containing alarm circuits, terminals, termination strips, fiber converter, etc. will be monitored for tampering and power failure. Non-JCI Cardkey cans will use UTC 3012-N tamper switches. Power fail circuits must be configured to monitor for extended power loss, not power "bumps". Circuit/device protection (fuses) must be included and designed to expedite troubleshooting of the alarm system.

5.01 Card Reader Requirements

- A. The standard card reader for perimeter access is Mercury Security Model MS-BR20-0W-T3. This is a track 3 magnetic stripe card reader. Card readers will be equipped with UTC 1035W magnetic switches and will be installed and lubricated per manufacturers' specification. Each card reader is to control (unlock) only one door. Any card reader exposed directly to the elements must be protected by a weatherized rain hood positioned for card reader ease of use and removal for servicing.

5.02 Door Hardware Requirements

- A. **Perimeter Card Reader Doors to be equipped as follows:**
 - 1. Doors must be fitted with Von Duprin Rim exit devices. Concealed and/or surface vertical rod exit devices are not permitted. Exit devices are to be fitted with EL (Electric Latch Retraction) functionality, RX (Request to Exit) monitoring switch, LX (Latch Bolt) monitoring switch and LC (Low Current) - rated contacts. All rim/panic devices shall be mounted to doors per Allegion specifications which include using 10x24x1" pan head Phillips-type machine screws with holes drilled and tapped to accommodate said machine screws. Case covers and end caps shall be secured with the Phillips-type screws provided with the rim device. Use Molex receptacle (mfg. part # 03-06-1062) with female pin connectors (mfg. part# 02-06-1103-C) where cable from EPT enters exit device. Use Molex receptacle (mfg. part # 03-06-2061) with male pin connectors (mfg. part # 02-06-2103-C) on exit device solenoid and switch wires. EPT wires transmitting power should be doubled up at both frame and exit device side to accommodate high current loads.
 - 2. EL exit devices are to be powered with Von Duprin PS914-2RS power supply only. Not more than two EL devices shall be connected to a single PS914-2RS.
 - 3. Von Duprin EPT-10 (Electric Power Transfer) to be used for the transferring of power and data signals from door frame to door. Use Molex receptacle (mfg. part # 03-06- 1062) with female pin connectors (mfg. part# 02-06-1103-C) where cable from door frame meets EPT. Use Molex receptacle (mfg. part # 03-06-2061) with male pin connectors (mfg. part # 02-06-2103-C) on door frame side of EPT wires. Molex connectors used on exterior door EPT must be lubricated with dielectric lubricant (white petrolatum) and must be wrapped in electrical tape to protect pin connectors and wire from exposure to moisture.

NOTE: RED & GREEN wires shall be doubled up for 24 VDC (+) positive.
BLACK & BROWN wires shall be doubled up for 24VDC (-) negative.
 - 4. DSM (Door Switch Monitor) UTC 1078 1" diameter concealed magnetic door switch to be installed on all monitored doors. Doors to be monitored on a schedule. Consult WSU Police alarm system administrator for specific times.

- a. Mercury Security Model MS-BR20-0W-T3 Magnetic Stripe card reader to be installed. This is a track 3 magnetic stripe card reader. Card readers will be equipped with magnetic tamper switch GE UTC 1035W. Reader will be installed and lubricated per manufacturers' specifications. Each card reader is to control (unlock) only one door. Any card readers exposed directly to the elements must be protected by a weatherized rain hood positioned for card reader ease of use and removal for servicing.
- b. When ADA Auto Operators exist they must be interfaced to access control system/electrified hardware. Exterior ADA actuators must be disabled whenever the electrified hardware is locked and enabled only after the card and PIN have been presented at the reader to allow access.

B. Routinely used Non Card Reader Pedestrian Doors to be equipped as follows:

1. Doors must be fitted with Von Duprin Rim exit devices. Concealed and/or surface vertical rod exit devices are not permitted. Exit devices to be fitted with EL (Electric Latch Retraction) functionality, RX (Request to Exit) monitoring switch, LX (Latch Bolt) monitoring switch and LC (Low Current)-rated contacts. All rim/panic devices shall be mounted to doors per Ingersoll-Rand specifications which include using 10x24x1" pan head Phillips-type machine screws with holes drilled and tapped to accommodate machine screws. Case covers and end caps shall be secured with the Phillips-type screws provided with the rim device. Use Molex receptacle (mfg. part # 03-06-1062) with female pin connectors (mfg. part# 02-06-1103-C) where cable from EPT enters exit device. Use Molex receptacle (mfg. part # 03-06-2061) with male pin connectors (mfg. part # 02-06-2103-C) on exit device solenoid and switch wires. EPT wires transmitting power should be doubled up at both frame and exit device side of EPT to accommodate high current loads.
2. EL exit devices are to be powered with Von Duprin PS914-2RS power supply only. Not more than two EL devices shall be connected to a single PS914-2RS.
3. Von Duprin EPT-10 (Electric Power Transfer) to be used for the transferring of power and data signals from door frame to door. Use Molex receptacle (mfg. part # 03-06-1062) with female pin connectors (mfg. part# 02-06-1103-C) where cable from door frame meets EPT and where cable enters rim device. Use Molex receptacle (mfg. part # 03-06-2061) with male pin connectors (mfg. part # 02-06-2103-C) on door frame side of EPT and on wires leading to rim device's switches. Molex connectors used on exterior door EPT must be lubricated with dielectric lubricant (white petrolatum) and must be wrapped in electrical tape to protect pin connectors and wire from exposure to moisture.
4. DSM (Door Switch Monitor) UTC 1078 1" diameter concealed magnetic door switch to be installed on all perimeter doors. Doors to be monitored on a schedule; consult WSU Police alarm system administrator for specific times.

C. Emergency Exit Doors to be equipped as follows:

1. Doors must be fitted with Von Duprin Rim exit devices. Concealed and/or surface vertical rod exit devices are not permitted. Exit devices to be fitted with RX (Request to Exit) monitoring switch, LX (Latch Bolt) monitoring switch and LC (Low Current) - rated contacts. Where emergency (TDE) time delayed egress is required the exit devices shall be fitted with CX (Chexit) 15 Second Time Delayed Egress Module. All rim/panic devices shall be mounted to doors per Allegion specifications which include using 10x24x1" pan head Phillips-type machine screws with holes drilled and tapped to accommodate said machine screws. Case covers and end caps shall be secured with the Phillips type screws provided with the rim device. Use Molex receptacle (mfg. part # 03-06-1062) with female pin connectors (mfg. part# 02-06-1103-C) where cable from EPT enters exit device. Use Molex receptacle (mfg. part # 03-06-2061) with male pin connectors (mfg. part # 02-06-2103-C) on exit device solenoid and switch wires. EPT wires transmitting power should be doubled up at both frame and exit device side of EPT to accommodate high current loads.
2. Von Duprin EPT-10 (Electric Power Transfer) to be used for the transferring of power and data signals from door frame to door. Use Molex receptacle (mfg. part # 03-06-1062) with female pin connectors (mfg. part# 02-06-1103-C) where cable from door frame meets EPT and where cable enters rim device. Use Molex receptacle (mfg. part # 03-06-2061) with male pin connectors (mfg. part # 02-06-2103-C) on door frame side of EPT and on wires leading to rim device's switches. Molex connectors used on exterior door EPT must be

lubricated with dielectric lubricant (white petrolatum) and must be wrapped in electrical tape to protect pin connectors and wire from exposure to moisture.

3. DMA (Door Management Alarm) Design Security Inc. DSI 4200-K4-T1 Local audible exit alarm with output control capability. DMA to be wall mounted on gang back box. DMA to be powered via hardwired DC power source from ACP (Access Control Processor) auxiliary power supply location. RX, LX and DSM to be interfaced with DMA. DMA audible alert to activate upon egress. Audible alert to auto-reset 30 seconds after door secures. Consult WSU Police alarm system administrator for specific DMA configuration.
4. DSM (Door Switch Monitor) UTC 1078 1" diameter concealed magnetic door switch to be installed on all perimeter doors. Doors to be monitored on a schedule. Consult WSU Police alarm system administrator for specific times.

D. Roof and Mechanical Room Doors to be equipped as follows:

1. DSM (Door Switch Monitor) UTC 1078 1" diameter concealed magnetic door switch to be installed on all perimeter doors. Doors to be monitored on a schedule. Consult WSU Police alarm system administrator for specific times.
2. Custom Signage shall be installed at roof hatch indicating the hatch is armed and to contact WSU Police before opening.

E. Perimeter Overhead Doors to be equipped as follows:

1. DSM (Door Switch Monitor) UTC 2205AL x 1912L surface-mounted overhead magnetic door switch to be installed on all perimeter overhead doors. Doors to be monitored on a schedule. Consult WSU Police alarm system administrator for specific times.
2. Custom Signage shall be installed at roof hatch indicating the hatch is armed and to contact WSU Police before opening.

F. Roof Hatches to be equipped as follows:

1. DSM (Door Switch Monitor) UTC 2505A x 1912L surface-mounted, magnetic door switch to be installed on all roof hatches. Roof hatches are to be monitored on a schedule. Consult WSU Police alarm system administrator for specific times.
2. Custom Signage shall be installed at roof hatch indicating the hatch is armed and to contact WSU Police before opening.

5.03 Perimeter Building Protection

All perimeter glass accessible from grade or some other nearby elevated platform (e.g. overhangs, canopies, half story roofs, second story roofs, adjacent buildings, trees, etc.) are to be protected with Glassbreak Sensors or PIR Motion Sensors. Perimeter monitoring devices are interfaced with the building ACP input and output boards and are monitored and controlled by WSU Police via the P2000 Server. All perimeter sensors are connected to individual inputs on JCI I/O boards. WSU Police must have the ability to shunt, arm and disarm all perimeter sensors via outputs on the JCI I/O boards. Consult with WSU Police alarm system administrator for specific intrusion alarm programming configurations. Acceptable sensors are as follows:

- A. GB (Glassbreak Sensor) Honeywell FG1625 glassbreak sensors to be used where protecting perimeter windows is necessary. Where multiple glass break sensors are located in close proximity to each other, they must be wired to a nearby centrally-located junction box. The glass break sensors must be wired in series with each other to said junction box with a single cable pair wired to the JCI I/O board. This configuration reduces the number of required inputs. The junction box must contain termination strips and associated components required for proper monitoring and control of the sensors. Junction boxes must be documented on CAD drawings as a single zone and include all termination points, cable colors, cable types, etc. Sensors wired in a daisy chain configuration are not acceptable. A dedicated output on the JCI I/O board controlled by WSU Police is required to remotely reset power to sensors after activation.

- B. GB-V (Vestibule Glassbreak Sensor) DSC BV-502GB glassbreak sensor to be used when protecting entryway vestibule glass doors. GB-V sensors must be home run to the JCI I/O board and not part of a zone configuration. Motion sensor shall shunt glassbreak sensor when pedestrians are exiting the building.
- C. MD (PIR Motion Sensor) Visionic SRN-2000 PIR Motion Sensors. PIR sensors are only acceptable when interior spaces are not occupied after normal business hours and building is armed by scheduled output from P2000 Server.

6.01 Intrusion Alarms for Interior Rooms & Office Suites

Intrusion alarms are implemented for the protection of personnel and property on interior office suites, animal labs, distance learning labs, computer labs etc. The intrusion alarms are managed locally by the end users and monitored remotely by WSU Police. Intrusion alarms consist of the following devices:

- A. Use Ademco/Honeywell Vista -128B controller with Ademco/Honeywell 6160 keypad to control internal alarms on any internal suite or alarmed areas. WSUPD must have ability to arm/disarm intrusion alarm with P2000 server. Use GE3012-N tamper switch on keypad and equipment cabinets.

NOTE: Vendor shall provide floor plans indicating device locations, zone list and zone types.
- B. All intrusion alarms must be equipped with a Honeywell 4204 relay module. The 4204's outputs will interface directly to JCI S300-DIN-I804 or S300-DIN-I32O16 input/output boards via a hardwire connection and will report four general alarm conditions: Intrusion, Low Battery, Tamper, keypad armed. (Note: Large systems may require additional zone reporting and therefore additional 4204 relay boards).
- C. An output from a JCI I/O board will be hardwired to the keyswitch input of the Honeywell Vista 128B controller. The output shall be programmed to allow WSUPD the ability to disarm the intrusion alarm system from the P2000 server when necessary.
- D. DSM (Door Switch Monitor) Use UTC 1078 1" diameter magnetic door switch.
- E. GB (Glassbreak Detector) Use Honeywell Flex Guard V-Plex model FG1625SN glass break Sensors when connecting to a Honeywell VISTA 128BPT alarm panel.
- F. GB (Glassbreak Detector) Use Honeywell model FG1625/T glass break sensors when connecting directly to JCI input board.
- G. MD (PIR Motion Detector) Use Honeywell DT 7500 SN Dual TEC motion sensors when using V-PLEX polling loop or Visionic SRN-2000 motion sensors when used in a home run configuration.
- H. A 12v/7Ah gel cell battery must be provided with every Vista 128B controller.
- I. A separate equipment cabinet must be provided to properly house Honeywell 4204 relay interface boards, Honeywell loop extenders (when necessary), terminal strips, timers, transformers, 120VAC receptacles, etc. Cabinet must also include GE3012-N tamper switch and cabinet lock 4T3252.

7.01 Miscellaneous System Requirements:

- A. Non-Card Reader doors, should unlock via electrified Von Duprin rim/panic device and output controls.
- B. Equipment Cabinet/Terminal Cabinets locks: Use # 237 cam lock for JCI Cardkey panels, and CCL # 15748-US26D-C4L-KA4T3252 for terminal cabinets. Terminal Cabinet Locks may require Brass Spacer CCL # 2540 x US4 for proper operation of tamper switch.

- C. No splicing of wire runs allowed; all wire runs shall be complete runs without wire nuts, splices or splice boxes. Wire and cables to card readers, magnetic door switches and between EPT must be soldered and shrink wrapped to protect cables.
- G. Surface-mounted cable runs of any kind are not permitted; all cable runs will be concealed.
- H. Installer of WSUPD security/access control systems must demonstrate to an authorized member of WSUPD that all parts of said systems are built to our specifications and function properly.

8.01 As-Built and Riser Drawing Requirements:

- A. As-built drawings must be provided, and must include cable designations, wire type, gauge and color.
- B. As-built drawings must detail model and/or part number of devices being used and include an illustrated parts list
- C. As-built drawings must also detail interconnection wiring between terminal boards as well as the location, address and switch settings of terminal boards.
- D. As-built drawings must detail CK721A wiring and communication path. As-built drawings must detail support hardware (e.g. power supply, UPS, and fiber converters).
- E. Riser drawings must show elevation detail of doors, glassbreak detectors, card readers and other devices.
- F. As-built and riser drawings must be sized on 42 inch by 30 inch paper and must be legible.

9.01 Cable Requirements

Application	Wire Type
1. Fiber converter to Cardkey panel	24 AWG x 4 Pair – Solid Jacketed Copper Plenum CAT – 5
2. Fire, Trouble & Supervisory inputs to board	18 AWG x 1 Pair – Solid Jacketed Fire-Rated Plenum
3. Auto operator or temp probe to board	22 AWG x 4 Cond. w/Stranded Flexible Jacketed Plenum
4. Cabinet tamper / glass break reset	22 AWG x 2 Cond. w/Stranded Flexible Jacketed Plenum
5. Auto operator buttons or input	18 AWG X 2 Cond. w/Stranded Flexible Jacketed Plenum
6. Power to Vista 128BP glassbreak to terminal strips	22 AWG X 6 Cond. w/Stranded Shielded Flexible Jacketed Plenum
7. Data	24 AWG x 1 Pair w/Overall Braided Shield Plenum
8. Rim device alarm to terminal strips	22 AWG x 2 Pair w/Stranded Overall Braided Shield Plenum
9. Input board from various devices	22 AWG x 1 Pair w/Stranded Overall Braided Shield Plenum
10. Rim device to power boosters	14 AWG x 2 with Stranded Flexible Jacketed Plenum
11. Terminal strips to alarm boards	22 AWG x 4 Pair Stranded Shielded Jacketed Plenum
12. Card reader to RDR2SA board	22 AWG x 8 Cond. w/Overall Shielded Jacketed Plenum
13. Power to ALK / DMA	18 AWG x 1 Pair Stranded Jacketed Plenum

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

**End of Section
281000**

Electronic Access Control
And Intrusion Detection Systems

28 10 00 - 22

SECTION 28 23 00 - VIDEO SURVEILLANCE SYSTEM (VSS)

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract and Division 1 Specifications Sections apply to this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of Video Surveillance System is listed on drawings and schedules and includes:
 - 1. Indoor Vandal Resistant Static IP Cameras
 - 2. Outdoor Vandal Resistant Static IP cameras
 - 3. Outdoor Vandal Resistant Multi Sensor Static IP Cameras
 - 4. Outdoor Vandal Resistant PTZ IP Cameras
 - 5. Camera Licenses
 - 6. Desktop Computers w/ VMS Client Software
 - 7. Network Video Recorder
 - 8. Video Management Software
 - 9. Mount Boxes / Connectors & Fittings
 - 10. Ceiling / Brackets & Adapters
 - 11. Patch Cords
 - 12. Cabling
- B. Provide all components and work as shown in the specifications and drawings, and also include all necessary components not listed as may be required to provide the correct system operation.
- C. Section 271300 shall furnish and install all network drops required to support CCTV system.
- D. Section 271300 shall furnish and install all associated data cabling, connectors, patch panel, terminations, testing, and cable certification to support all IP cameras.
- E. Coordinate with WSU-C&IT representative to collect system information for initial configuration through final system turn on and test. Compile checklist to verify that all devices have been tested and report properly on system server.
- F. Document video surveillance system programming on configuration sheets and assist WSU-C&IT with entering the new device data into the NVR.
- G. Generate CCTV Master Spreadsheet containing camera brand, model #, type, frame rate, resolution, record schedule, motion detection, MAC address, IP address, power source, network switch address, network switch port, MDF/IDF room #, and all other pertinent information for each camera.

1.3 RELATED SECTIONS

- A. Section 27 11 00 – Basic Voice & Data Systems (Refer to the “Wayne State University Standards for Communication Infrastructure” to ensure compliancy with WSU C&IT requirements. See Exhibit A at the end of this section for a link to the document.)

- B. Section 27 15 00 – Backbone and Horizontal Cabling for Voice & Data Systems (Refer to the “Wayne State University Standards for Communication Infrastructure” to ensure compliancy with WSU C&IT requirements. See Exhibit A at the end of this section for a link to the document.)
- C. Refer to Division 26 Sections for Electrical work. All conduits, conduit pull strings, back boxes and 120VAC shall be provided and installed by electrical contractor as indicated on security drawings. Equipment cabinets shall be provided by security contractor and installed by electrical contractor as indicated on security drawings.

1.4 REFERENCES

- A. The Codes and Regulations listed below form a part of this specification to the extent referenced. Work shall be performed in accordance with the applicable international, federal, state, and local codes or standards current at the commencement of installation. The following list summarizes applicable standards including but not limited to.
 - 1. UL 294, UL 1076, ULC
 - 2. CE
 - 3. FCC – Part 15, Part 68
 - 4. NFPA 70, NEC
 - 5. IEEE, RS 170 variable standard
- B. Where more than one code or regulation is applicable, the more stringent shall apply.
- C. Cable and equipment installation, identification and termination shall be performed in accordance to the applicable codes above.

1.5 DEFINITIONS

- 1. CCTV = Closed Circuit Television
- 2. GUI = Graphical User Interface
- 3. LAN = Local Area Network
- 4. IP = Internet Protocol
- 5. NVR = Network Video Recorder
- 6. PoE = Power over Ethernet
- 7. WAN = Wide Area Network
- 8. VSS = Video Surveillance System
- 9. VMS = Video Management System
- 10. WSU-C&IT = Wayne State University Computer and Information Technology
- 11. WSU-DS = Wayne State University Design Services
- 12. WSU-Police = Wayne State University Police Department
- 13. CCTV = Closed Circuit Television

1.6 SUBMITTALS

General: Submit the following in accordance with the conditions of Contract and Division 1 Specifications Sections.

- A. Product Data: Submit manufacturer's specifications and installation instructions for types of VSS equipment indicated.
- B. Schedule: After formal notice of award, prepare a VSS schedule setting forth the items proposed to be furnished for every video system device location. Submit proper number of copies of this schedule to allow the architect to retain two copies and to furnish one copy for the owner, plus the

number of copies required by the design / builder for its distribution and use (8 copies max.) The schedule shall be written in the exact format as the specification wherein the information shall provide the camera device location description, and shall state the name of the manufacturer, and type and number of each device proposed to be used.

Type the security schedule double spaced and submit on 8 ½ x 11-inch sheets of paper. Submittals not following this format will be returned unchecked.

- C. Shop Drawings: Submit (8) copies of shop drawings which include floor plan layouts, riser diagrams, wiring diagrams and other information and details required for coordinating installation with other related work.

Drawings shall be identical versions of VSS drawings pertaining to this section with changes and additional details and shall include the following at a minimum:

- a. Floor plans showing camera and device locations marked legibly and in an acceptable manner.
- b. Riser diagrams showing proposed cable runs from each camera with cable manufacturer, cable description and outside diameter clearly marked.
- c. Wiring diagrams showing all devices in system with point to point wiring between every device.

All drawings shall be professionally and clearly produced using AutoCAD 2014 + or they will be returned unchecked.

1.7 AS-BUILT DRAWINGS

- A. Assemble three as-built job binders, indexed with the following as-built information.
1. Index 1 "VSS Schedule": Copy of VSS schedule similar to submittal schedule but revised to indicate as-built material listing.
 2. Index 2 "Data Sheets / Manuals": Copy of all data sheets and / or manuals for all devices listed in VSS schedule.
 3. Index 3 "Floor Plans": Copy of VSS floor plans similar to the submittal floor plans but revised to indicate as-built conditions.
 4. Index 4 "Riser Diagrams": Copy of riser diagrams similar to submittal riser diagrams but revised to indicate as-built conditions.
 5. Index 5 "Wiring Diagrams": Copy of wiring diagrams showing all devices in system with point to point wiring between every device.

1.8 QUALITY ASSURANCE

General: Video Surveillance System shall be provided and installed by a Security Systems Integrator, who is a factory direct Certified Integrator for each of the specified products and who also meets the following requirements:

- A. Insurance and Indemnity: The contractor must take out and maintain, during the life of this agreement, insurance coverage as set forth by owner.
- B. Must have been engaged in the business of providing, installing, servicing, and maintaining similar VSS measures in similar environments during the past five (5) years.
- C. Must be able to show evidence of past experience furnishing and servicing video surveillance systems specified in this section.

- D. Must meet all applicable licensing and regulatory requirements of the State of Michigan, particularly Public Act 330.
- E. Must meet all applicable local jurisdiction licensing requirements.
- F. Must have a local support capacity consistent with the demands of this project and other local clients.
- G. Must have a properly staffed facility with a properly stocked equipment warehouse within a one (1) hour drive of the job site.
- H. Video Surveillance Systems Contractor must be a member of Local 58 to avoid job delays. Subcontract work will not be accepted.
- I. Must purchase all equipment directly from manufactures listed. Contractors who intend to procure equipment through wholesale houses, distributors, or other security integrators will be disqualified.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver equipment to job site unless otherwise required or directed, wrapped in separate packages, complete with all accessories and fasteners for each camera, labeled, and numbered for each camera location.
- B. Furnish typewritten schedule with each shipment in conformity with approved schedule. Furnish receipts in duplicate upon delivery of equipment to the project site.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers and models specified in this Section shall be as listed herein with no substitutions allowed.
 - 1. Indoor Static Vandal Resistant IP Cameras – AXIS
 - 2. Outdoor Static Single Sensor Vandal Resistant IP Cameras – AXIS
 - 3. Outdoor Static Multi Sensor Vandal Resistant IP Cameras – AXIS
 - 4. Outdoor PTZ Single Sensor Vandal Resistant IP Cameras – AXIS
 - 5. Pole Mount Brackets - AXIS
 - 6. Recessed Mounting Kit – AXIS
 - 7. Wall Mounts Brackets – AXIS
 - 8. Pendant Mount Brackets - AXIS
 - 9. J-Box Mounting Plate – AXIS
 - 10. Surface Mount Back Box – AXIS
 - 11. Ethernet Extenders – Comnet
 - 12. Ethernet Surge Suppressor – Comnet
 - 13. Surge Protectors - Ditek
 - 14. Network Video Recorder / Server - NICE
 - 15. Video Management Software – NICE
 - 16. IP Camera Licenses – NICE
 - 17. PTZ Mount Bracket – Ramtel

2.2 VIDEO SURVEILLANCE SYSTEM EQUIPMENT SETS

Video Surveillance System equipment sets list components supplied under this section.

CCTV Set A

2MP Indoor Surface Wall Mounted Static Camera

CL-2 Indoor Static IP Camera Located Lower Level North End of Corridor 090.01 Viewing South

Operation: Digital Video Recorded on NICE NVR at WSU-C&IT / Video Monitored and Controlled from WSU-DPS

<u>Item</u>	<u>Division Section</u>	<u>Qty.</u>	<u>Description</u>
1.	282300	1	Vandal Res. Indoor IP Camera AXIS # P3225-LV Mk II
2.	282300	1	Camera Cat 6 Patch Cords (Purple)
3.	271300	1	Cat 6 RJ-45 Modular Jacks (Purple)
4.	271300	1	Single Port Mounting Boxes for Cat 6 RJ-45 Modular Jacks
5.	271300	Lot	Cat6+ Plenum Cable
6.	282300	Lot	Mounting Hardware
7.	282300	Lot	labor to coordinate installation of camera data cabling with section 271300. Fish cables to device locations. Document all pertinent camera information onto CCTV system master spread sheet. Deliver assemble and install above mount brackets, cameras, patch cords, junction boxes and all associated hardware. Patch each camera into owner supplied PoE network switch. Terminate, turn on and program IP address, MAC address, camera name descriptors, motion detection patterns and recording schedules. Test cameras for proper operation. Perform final adjustments.

- Camera cabling to be provided, installed and certified per WSU standards by data cabling contractor. See Exhibit "A" at the end of this specification section for a link to the WSU C&IT Communication Standard for approved products.
- Cameras cables shall be run to nearest MDF / IFD closet and connected to WSU designated Wireless Access Point / CCTV PoE switch.
- VSS Contractor to coordinate walk test of all cameras with WSU C&IT representative for final approval.
- VSS Contractor to verify camera mounting conditions and provide appropriate mounting brackets and hardware for a Safe and esthetically pleasing installation. Review mounting methods with architect prior to installation.

CCTV Set B

2MP Indoor Pendant Mounted Static Camera

C1-4 Indoor Static IP Camera Located 1st Floor South East Corner of Lounge 125

Operation: Digital Video Recorded on NICE NVR at WSU-C&IT / Video Monitored and Controlled from WSU-DPS

<u>Item</u>	<u>Division</u> <u>Section</u>	<u>Qty.</u>	<u>Description</u>
1.	282300*	1	Vandal Res. Indoor IP Camera AXIS # P3225-LV Mk II
2.	282300*	1	Pendant Kit AXIS # T94K01D
3.	282300*	1	Ceiling Mount AXIS # T91B51
4.	282300*	1	Down Rod 1.5" NPT x (Length TBD & Paint to Match Camera Housing)
5.	282300	1	Camera Cat 6 Patch Cords (Purple)
6.	271300	1	Cat 6 RJ-45 Modular Jacks (Purple)
7.	271300	1	Single Port Mounting Boxes for Cat 6 RJ-45 Modular Jacks
8.	271300	Lot	Cat6+ Plenum Cable
9.	282300	Lot	Mounting Hardware
10.	282300	Lot	labor to coordinate installation of camera data cabling with section 271300. Fish cables to device locations. Document all pertinent camera information onto CCTV system master spread sheet. Deliver assemble and install above mount brackets, cameras, patch cords, junction boxes and all associated hardware. Patch each camera into owner supplied PoE network switch. Terminate, turn on and program IP address, MAC address, camera name descriptors, motion detection patterns and recording schedules. Test cameras for proper operation. Perform final adjustments.

- Camera cabling to be provided, installed and certified per WSU standards by data cabling contractor. See Exhibit "A" at the end of this specification section for a link to the WSU C&IT Communication Standard for approved products.
- Cameras cables shall be run to nearest MDF / IFD closet and connected to WSU designated Wireless Access Point / CCTV PoE switch.
- VSS Contractor to coordinate walk test of all cameras with WSU C&IT representative for final approval.
- VSS Contractor to verify camera mounting conditions and provide appropriate mounting brackets and hardware for a Safe and esthetically pleasing installation. Review mounting methods with architect prior to installation.

*** IF ALTERNATE NO.1 IS ACCEPTED THE ABOVE CAMERA AND ASSOCIATED ACCESSORIES SHALL BE OMITTED AND REPLACED WITH EXISTING CAMERA LOCATED ON SOUTH EAST EXTERIOR CORNER OF BUILDING CURRENTLY VIEWING EAST COURTYARD. SECURITY CONTRACTOR TO REPURPOSE EXISTING CAMERA, MOUNT AND DATA DROP. ALL REPAIRS TO SOFFIT AND BRICK SHALL BE PROVIDED BY GC.**

CCTV SET C

8MP 360 Degree Indoor Surface Ceiling Mt. Multi Sensor Static Camera

CL-1 360 Degree Static IP Camera Located Lower Level Elevator Lobby (**As Noted on Floor Plan**)

Operation: Digital Video Recorded on NICE NVR at WSU-C&IT / Video Monitored and Controlled from WSU-DPS

Division

<u>Item</u>	<u>Section</u>	<u>Qty.</u>	<u>Description</u>
1.	282300	1	Vandal Res. Indoor IP Camera AXIS # P3717-PLE
2.	282300	1	Camera Cat 6 Patch Cords (Purple)
3.	271300	1	Cat 6 RJ-45 Modular Jacks (Purple)
4.	271300	1	Single Port Mounting Boxes for Cat 6 RJ-45 Modular Jacks
5.	160000	Lot	Conduit / Back Boxes / Fittings
6.	271300	Lot	Cat6+ Plenum Cable
7.	282300	Lot	Mounting Hardware
8.	282300	Lot	labor to coordinate installation of camera data cabling with section 271300. Fish cables to device locations. Document all pertinent camera information onto CCTV system master spread sheet. Deliver assemble and install above mount brackets, cameras, patch cords, junction boxes and all associated hardware. Patch each camera into owner supplied PoE network switch. Terminate, turn on and program IP address, MAC address, camera name descriptors, motion detection patterns and recording schedules. Test cameras for proper operation. Perform final adjustments.

- Conduit, back boxes and pull strings shall be providing and install by Division 16.
- Camera cabling to be provided, installed and certified per WSU standards by data cabling contractor. See Exhibit "A" at the end of this specification section for a link to the WSU C&IT Communication Standard for approved products.
- Cameras cables shall be run to nearest MDF / IFD closet and connected to WSU designated Wireless Access Point / CCTV PoE switch.
- VSS Contractor to coordinate walk test of all cameras with WSU C&IT representative for final approval.
- VSS Contractor to verify camera mounting conditions and provide appropriate mounting brackets and hardware for a Safe and esthetically pleasing installation. Review mounting methods with architect prior to installation.

***ALTERNATE No.1**

CCTV SET-D

2MP Outdoor Wall Mounted Static Cameras w/ Verifocal Lens & WDR

CO-6 Outdoor Static IP Camera Located North End East Courtyard

Operation: Digital Video Recorded on NICE NVR at WSU-C&IT / Video Monitored and Controlled from WSU-DPS

<u>Item</u>	<u>Division Section</u>	<u>Qty</u>	<u>Description</u>
1.	282300	1	Vandal Res. Outdoor IP Cameras AXIS # P3807-PVE
2.	282300	1	Pendant Mount Kits AXIS # T94V02D
3.	282300	1	Wall Mount AXIS # T91D61
4.	282300	2	Ethernet Surge Protector L-COM # BT-CAT6-P1-HP
5.	282300	1	Camera Cat 6 Patch Cords (Purple)
6.	271300	1	Cat 6 RJ-45 Modular Jack (Purple)
7.	271300	1	Single Port Mounting Box for Cat 6 RJ-45 Modular Jack
8.	271300	Lot	Cat6+ Plenum Cabling (Plenum Rated Ceiling)
9.	271300	Lot	UV Rated Cat6 Cabling (Building to Camera)

10.	160000	Lot	Conduit / Back Boxes / Fittings / Junction Box / Ground Cable
11.	282300	Lot	Mounting Hardware
12.	282300	Lot	labor to coordinate installation of camera data cabling with section 271300. Fish cable to device locations. Document all pertinent camera information onto CCTV system master spread sheet. Deliver install and terminate above surface mount back boxes, cameras, patch cables, junction boxes and all associated hardware. Patch each camera into owner supplied PoE network switch. Turn on and program IP address, MAC address, camera name descriptors, motion detection patterns and recording schedules. Test cameras for proper operation. Perform final adjustments.

- Camera cabling to be provided, installed and certified per WSU standards by data cabling contractor. See Exhibit "A" at the end of this specification section for a link to the WSU C&IT Communication Standard for approved products.
- Cameras cables shall be run to nearest MDF / IFD closet and connected to WSU designated Wireless Access Point / CCTV PoE switch.
- VSS Contractor shall install and properly ground Ethernet surge protectors at camera and network switch locations.
- VSS Contractor to coordinate walk test of all cameras with WSU C&IT representative for final approval.
- VSS Contractor to verify camera mounting conditions and provide appropriate mounting brackets and hardware for a Safe and esthetically pleasing installation. Review mounting methods with architect prior to installation.

***CONDUIT, BACK BOXES AND PULL STRINGS SHALL BE PROVIDING AND INSTALL BY DIVISION 16 AND SHALL BE INCLUDED AS BASE BID. PROVIDE ALTERNATE PRICE FOR ALL ABOVE MATERIAL & LABOR.**

CCTV SET-E

VMS (Video Management System)

Existing NVR (Network Video Recorder / Server) Located 5925 Woodward

Existing VMS (Video Management Software / NICE) Located 5925 Woodward.

<u>Item</u>	<u>Division Section</u>	<u>Qty.</u>	<u>Description</u>
1.	Existing	1	VMS Enterprise Software Qognify Nice Vision
2.	WSU-DS	1	Network Video Recorder / Server Dell # XXX
3.	WSU-DS	20	Single IP Camera License NICE # XXX
4.	282300	Lot	Labor as follows: <ul style="list-style-type: none"> • Coordinate with WSU-DS project manager and WSU-C&IT representative for procurement of NVR server and NICE camera licenses. • Coordinate NVR configured with WSU-C&IT Representative.

CCTV SET-F

Engineering and Documentation

<u>Item</u>	<u>Supplier</u>	<u>Qty</u>	<u>Description</u>
1.	282300	Lot	Labor to engineer and produce VSS schedule and AutoCAD riser diagrams, floor plan layouts, and point-to-point wiring diagrams for VSS system. Provide three (3) sets of "As-Built" documents of VSS schedule, cut sheets, manuals, riser diagrams, floor plan layouts, and wiring diagrams. One (1) year labor and material warranty.

A. PART 3 – EXECUTION

3.1 SYSTEM INSTALLATION REQUIREMENTS

- A. General: Comply with manufacturer's instructions for assembly and installation of video surveillance system equipment.
1. Install video surveillance system components in locations indicated with work plumb, level, true, and straight with no distortions. Secure exposed work with security fasteners.
 2. Coordinate with Owner's representative as required to provide a complete functional system.
 3. Make final electrical connections to video surveillance system components.
 4. Turn on and test all system components and system as a whole.
 5. Secure all multiple termination points on terminal blocks.
 6. Secure all exposed panels with tamper resistant screws. Supply owner with two (2) tools for removing all tamper-resistant hardware.
 7. Directly hardwire all field AC power to equipment as required.
 8. Perform all work required to cut, patch, and mount video surveillance system equipment.
 9. All wiring shall be in accordance with the manufacturers' requirements and all applicable codes and standards.
 10. Tie-wrap all cabling and distribute cleanly. Systematically, and logically number and mark all cabling using vinyl wire markers. Document all cabling runs, distribution, and terminations on the "As-built" drawings.
 11. VSS Communications Contractor to conceal all cabling in ceilings and walls or in a manner acceptable to the owner.
 12. Contractor shall remove only amounts of sprayed fire proofing necessary to install hangers and supports to complete their scope of work.
 13. Upon mobilizing, contractor shall submit an initial master construction schedule outlining their complete scope of work. This schedule shall be based on owners and general contractors sequencing, milestone dates, and schedule. Contractor shall then update their schedule and be available for discussion at weekly meetings.

14. Contractor shall provide all required fire stop systems to complete scope of work, and shall meet all requirements outlined in specifications' "Through Penetration Fire Stop Systems."
15. Contractor shall be responsible for all saw cutting, core drilling, patching, and fire stopping that is required to complete their scope of work unless otherwise specified.
16. When necessary the contractor must obtain approvals, permits, and coordinate the inspection and testing of the system with state and local governing agencies.
17. Provide all tests, data, affidavits, test results, and certificates required by the owner in a timely manner to facilitate owner occupancy.
18. Contractor will promptly process the submittals to ensure timely submittal of the items in this scope of work and ordering of the same.
19. Contractor shall, as deemed necessary by the owner, provide an up to date status on submittals, lead times, and expected delivery dates of the material/equipment to complete their scope of work.
20. Contractor shall be responsible for hoisting and scaffolding to complete their scope of work.
21. Contractor shall be responsible for their own clean-up costs and shall at all times maintain a clean and safe jobsite. Dumpsters will be provided by general contractor.
22. Provide and maintain an effective safety program that will be in agreement and conformity with the policies in the general contractor's health and safety manual.
23. Contractor is responsible for re-viewing the site and being familiar with all existing conditions pertaining to the project including local conditions and requirements.
24. Contractor shall be responsible for coordinating all required on-site testing, inspection, and quality assurance requirements. This contractor shall be responsible for conformance to all federal and local codes, regulations, testing, and inspection requirements as required for beneficial occupancy by the owner. Secure and provide all inspections and permits required. Complete all certification of items required by the contract specifications, and the code and governing bodies.

3.2 LABELING

- A. It is important that both labeling and color coding be applied to all video infrastructure components. Labeling with the unique identifier will identify a specific component. Proper color coding will quickly identify how that component is used in the overall systems infrastructure of the facility.
- B. Labeling
 1. Labels are generally of either the adhesive or insert type. All labels must be legible, resistant to defacement, and maintain adhesion to the application surface.
 2. Outside plant labels shall be totally waterproof, even when submerged.
 3. All labels shall be machine printed.

4. Labels applied directly to a cable shall have a clear vinyl wrapping applied over the label and around the cable to permanently affix the label.
5. Other types of labels, such as tie-on labels, may be used. However, the label must be appropriate for the environment in which it is used, and must be used in the manner intended by the manufacture.

3.2 ADJUSTMENTS, CLEANING, FINISHING AND PROTECTION

- A. Clean exposed and semi-exposed surfaces. Touch-up shop applied finishes to restore damaged or soiled areas.
- B. Operate video surveillance system including controls through all modes of operation and make final adjustments as necessary to ensure proper functionality.
- C. Instruct personnel in complete operation of system through all modes.

3.3 TRAINING

- A. Contractor shall include 8 hours of training sessions for the owner's personnel on the operation and maintenance of the video surveillance system equipment specified.
- B. Training courses shall be taught by a qualified representative at the owner's location.
- C. Contractor is responsible for providing all training materials. The owner will be responsible for providing the training room facilities at the owner's location.
- D. Contractor shall furnish for the owner four (4) copies of the systems manuals.
- E. System manuals shall contain the system block diagram, basic system operation outline, test reports, equipment service, repair, and owner's manuals, system layout, date of installation, and contact person and phone number.

3.4 WARRANTY

- A. The Contractor shall warrant the CCTV cameras and associated equipment to be free from inherent mechanical and electrical defects for a period of 24 months from the date of final acceptance by the owner.
- B. All proposed warranties shall be provided, as a minimum, from 8:00 AM – 4:30 PM Monday through Friday with response provided within four (4) business hours from the time of notification

3.5 ALTERNATE ADDS

N/A

PART 4 – Exhibits

4.1 Exhibit "A"

- A. VISIT THE FOLLOWING LINK FOR A COPY OF THE WSU STANDARDS FOR COMMUNICATIONS AND INFRASTRUCTURE

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

<http://computing.wayne.edu/docs/wsu-communications-standards.pdf>

WSU School of Social Work Phase 2
5447 Woodward
WSU Project Number: 063-301464

Hamilton Anderson Associates
HAA Project Number: 2013088.22
Issued for Bids June 20, 2019

End of Section
28 23 00

SECTION 28 31 00

FIRE ALARM

PART 1 GENERAL	1
1.01 RELATED DOCUMENTS	1
1.02 SUMMARY	1
1.03 DEFINITIONS	1
1.04 SYSTEM DESCRIPTION	2
1.05 PERFORMANCE REQUIREMENTS	2
1.06 SUBMITTALS	2
1.07 QUALITY ASSURANCE	3
1.08 PROJECT CONDITIONS	3
1.09 SEQUENCING AND SCHEDULING	3
PART 2 PRODUCTS	4
2.01 MANUFACTURERS	4
2.02 EXISTING FIRE ALARM SYSTEM	4
2.03 MANUAL FIRE ALARM BOXES	4
2.04 SYSTEM SMOKE DETECTORS	4
2.05 NOTIFICATION APPLIANCES	5
2.06 REMOTE STATUS AND ALARM INDICATORS	5
2.07 ADDRESSABLE INTERFACE DEVICE	5
2.08 ADDRESSABLE CONTROL MODULE	5
2.09 WIRE AND CABLE	5
PART 3 EXECUTION	6
3.01 EQUIPMENT INSTALLATION	6
3.02 WIRING INSTALLATION	6
3.03 IDENTIFICATION	7
3.04 FIELD QUALITY CONTROL	7
3.05 PROGRAMMING	8
3.06 ADJUSTING	8
3.07 WARRANTY	8
3.08 DEMONSTRATION	8

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 1. Division 26 Section "Electrical General Requirements."

1.02 SUMMARY

- A. This Section includes design and installation of new devices onto an existing fire alarm system.
- B. Related Sections include the following:
 1. Division 8 Section "Door Hardware" for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system.

1.03 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.04 SYSTEM DESCRIPTION

- A. Noncoded, addressable system; multiplexed signal transmission dedicated to fire alarm service only.
 - 1. Interface with existing fire alarm system.
- B. Noncoded, analog-addressable system; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.
 - 1. Interface with existing fire alarm system.
- C. Fire alarm system shall consist of the following:
 - 1. All new fire alarm control panel, devices, and wiring.
 - 2. System smoke detection as required at air handling units, smoke rated transfer openings, and smoke damper locations.
 - 3. System smoke detection in areas identified on plans
 - 4. All flow and tamper switches to monitor fire sprinkler and standpipe systems and report appropriate alarm and supervisory signals.
 - 5. Manual fire alarm boxes at each building exit (prior to entering exit stairwells at each floor).
 - 6. Audible and visual notification appliances in all public and common areas of the building.
 - 7. Fire pump monitoring.

1.05 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72.
- B. Comply with NFPA 70.
- C. A complete functional system meeting the requirements of this specification, including alarm initiating devices and notification appliances at locations and ratings to meet the requirements of the Authorities Having Jurisdiction and all applicable codes shall be provided.
- D. Coordinate and avoid conflicts with casework, markerboards, feature walls, and other areas where fire alarm devices would interfere with furnishings, finishes, etc.
- E. Fire alarm system vendor shall provide sound pressure level calculations demonstrating compliance with NFPA 72 and establish quantities and tap settings of audible devices.
- F. No additional charges for work or equipment required for a code compliant system approved by the Authority Having Jurisdiction will be allowed.
- G. Obtain and refer to mechanical drawings for smoke damper locations, smoke rated transfer openings, and air handling equipment CFM's. Provide smoke detection as required by applicable codes.
 - 1. Refer to drawings for complete code analysis including construction type, use groups, special occupancy types, rated walls, smoke barriers and partitions, etc.
- H. System functional performance shall be as indicated on the fire alarm matrix on the drawings.

1.06 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire alarm system design.
 - b. Fire alarm certified by NICET, minimum Level III.
 - 2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
 - 3. Device Address List: Include address descriptions that will appear on the FACP display.
 - 4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.

5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
 6. Batteries: Provide battery sizing calculations. Battery size shall be a minimum of 125% of the calculated requirement.
 7. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 8. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show device layout, size and route of cable and conduits.
- C. Qualification Data: For Installer.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.
- F. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- G. Documentation:
1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and Authorities Having Jurisdiction.
 2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.
 - a. Hard copies on paper to Owner, Architect, and Authorities Having Jurisdiction.
 - b. Electronic media may be provided to Architect.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Work of this Section be performed by a UL-listed company.
- C. Installer Qualifications: Personnel certified by NICET as Fire Alarm Level III.
- D. 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.

1.08 PROJECT CONDITIONS

- A. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
1. Notify Architect, Construction Manager and Owner no fewer than seven days in advance of proposed interruption of fire alarm service.
 2. Do not proceed with interruption of fire alarm service without Architect, Construction Manager and Owner written permission.

1.09 SEQUENCING AND SCHEDULING

- A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.

- B. Equipment Removal: After acceptance of the new fire alarm system, remove existing disconnected fire alarm equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. FACP and Equipment:
 - a. SimplexGrinnell LP; a Tyco International Company.

2.02 EXISTING FIRE ALARM SYSTEM

- A. Compatibility with Existing Equipment: Fire alarm system and components shall operate as an extension of an existing system.

2.03 MANUAL FIRE ALARM BOXES

- A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.
1. Single-action mechanism, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
 2. Station Reset: Key- or wrench-operated switch.

2.04 SYSTEM SMOKE DETECTORS

- A. General Description:
1. UL 268 listed, operating at 24-V dc, nominal.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 3. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
 4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 5. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
- B. Photoelectric Smoke Detectors:
1. Sensor: LED or infrared light source with matching silicon-cell receiver.
 2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
- C. Duct Smoke Detectors:
1. Photoelectric Smoke Detectors:
 - a. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
 2. UL 268A listed, operating at 24-V dc, nominal.
 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
 - a. Weatherproof Duct Housing Enclosure: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.
 5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.

6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. Provide remote status and alarm indicator and test station where required.
7. Each sensor shall have multiple levels of detection sensitivity.
8. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
9. Relay Fan Shutdown: Provide two (2) sets of contacts rated to interrupt fan motor-control circuit.

2.05 NOTIFICATION APPLIANCES

- A. Description: Equipped for mounting as indicated and with screw terminals for system connections.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
 2. Finishes:
 - a. Wall mounted appliances: Provide red finish with white lettering.
 - b. Ceiling Mounted Appliances: Provide white finish.
- B. Voice/Tone Speakers:
 1. UL 1480 listed.
 2. High-Range Units: Rated 2 to 15 W.
 3. Low-Range Units: Rated 1 to 2 W.
 4. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.
- C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
 1. Rated Light Output: 15, 30, 60, 75, 110, 135, 185 candela as required to meet NFPA 72 requirements.
 2. Strobe Leads: Factory connected to screw terminals.

2.06 REMOTE STATUS AND ALARM INDICATORS

- A. Remote status and alarm indicator and test stations, with LED indicating lights. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single-gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

2.07 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

2.08 ADDRESSABLE CONTROL MODULE

- A. Provide for integration of auxiliary control functions into the analog signaling circuit. Intelligent analog signaling circuit control module shall have the following capabilities:
 1. Communication interaction with the analog signaling circuit having the capability of initiating a control function to an auxiliary device based on a specified event.
 2. Provide NO/NC contact pairs rated at 2 amps 120 VAC or 24 VDC.

2.09 WIRE AND CABLE

- A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.
- B. Fire alarm wire and cable shall be as specified by the system manufacturer including conductor gage, conductor quantity, conductor twists and shielding required to meet NFPA class and style performance specified.
- C. Signaling Line Circuits and other power limited fire alarm circuits (PLFA):

1. PLFA circuits installed in conduit or raceway: U.L. Listed type FPL
 2. PLFA circuit cable installed exposed in accessible ceiling spaces, risers and elsewhere: U.L. Listed type FPLP.
- D. Non-Power-Limited Fire Alarm Circuits (NPLFA):
1. NPLFA circuits installed in conduit: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - a. Low-Voltage Circuits: No. 16 AWG, minimum.
 - b. Line-Voltage Circuits: No. 12 AWG, minimum.
 2. NPLFA circuit cable installed exposed in ceiling spaces, risers and elsewhere: Multi-conductor cable, U.L Listed type NPLFP.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

- A. Connecting to Existing Equipment: Verify that existing fire alarm system is operational before making changes or connections.
1. Connect new equipment to the existing control panel in the existing part of the building.
 2. Connect new equipment to the existing monitoring equipment at the Supervising Station.
 3. Expand, modify, and supplement the existing control and monitoring equipment as necessary to extend the existing control and monitoring functions to the new points.
 4. New components shall be capable of merging with the existing configuration without degrading the performance of either system.
- B. Smoke or Heat Detector Spacing:
1. Smooth ceiling spacing shall not exceed 30 feet or the listed spacing of the detectors, whichever is less.
 2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
 3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.
- C. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
- D. Duct Smoke Detectors: Comply with NFPA 72. Install sampling tubes so they extend the full width of the duct.
- E. Audible Alarm Notification Appliances: Install wall mounted appliances not less than 6 inches below the ceiling.
- F. Visible Alarm Notification Appliances: Install wall mounted appliances at 96" AFF or 6 inches below the ceiling, whichever is less.
- G. Coordinate ceiling mounted appliances with reflected ceiling plans. Do not install visual appliances where pendant mounted or suspended lighting fixtures will obstruct intended viewing angles.
- H. Install wall mounted and ceiling mounted notification appliances flush on recessed j-box or back box for all new work and on existing gyp-board partition walls.
- I. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- J. Provide all 120V branch circuits for all control panels, sub panels, and ancillary equipment required for the system.

3.02 WIRING INSTALLATION

- A. Install wiring according to the following:
1. NECA 1.
 2. TIA/EIA 568-A.
- B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes."

1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
1. Fire alarm circuits shall consist of multi-conductor cables installed in accessible ceiling spaces.
 2. Where ceilings consist of exposed construction, fire alarm multi-conductor cable shall be installed on top of joists, beams etc. and shall be concealed from view. Where the structural elements do not allow for the cable to be installed in a concealed fashion, then install the cable in conduit.
 3. Install fire alarm cable in conduit in mechanical rooms, loading docks and similar service spaces.
 4. Drops to surface mounted devices shall be installed in conduit or surface raceway. No exposed cable shall be visible below the ceiling. Where the ceiling is exposed, route the conduit or raceway up to the structural member that will conceal the cable.
 5. Drops to devices recessed in partition walls shall be installed in conduit.
 6. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
 7. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits, if the system manufacturer permits it.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

3.03 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Electrical Identification."

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
 2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
 - a. Include the existing system in tests and inspections.
 3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.

4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
 - a. Detectors that are outside their marked sensitivity range shall be replaced.
5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.05 PROGRAMMING

- A. Coordinate final address descriptions for alarm, supervisory and trouble indication that appear on FACP and Annunciator displays with the Owners representative. This shall include all room names, room numbers, building areas for fire protection zones, exit door descriptions and similar items. This coordination shall take place and be implemented in the programming prior to Demonstration and Owner Training.

3.06 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.
- B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods.

3.07 WARRANTY

- A. All newly installed equipment shall be warranted by the contractor for a period of one year following acceptance. The warranty shall include parts, labor, prompt field service, pickup and delivery.

3.08 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 28 31 00